UNITED STATES DISTRICT COURT

DISTRICT OF MINNESOTA

- -

In Re:

Bair Hugger Forced Air Warming

Products Liability Litigation

MDL No. 15-2666 (JNE/FLN)

This Document Relates To:

Gareis v 3M Co., et al

- -

DEPOSITION OF JOHN P. ABRAHAM, Ph.D.

VOLUME I, PAGES 1 - 290

FEBRUARY 15, 2018

(The following is the deposition of JOHN P. ABRAHAM, Ph.D., taken pursuant to Notice of Taking Deposition, via videotape, at the offices of Ciresi Conlin L.L.P., 225 South 6th Street, Suite 4600, in the City of Minneapolis, State of Minnesota, commencing at approximately 9:05 o'clock a.m., February 15, 2018.)

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APPEARANCES:

On Behalf of the Plaintiffs:

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Suite 200
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On Behalf of the Defendants:

Peter J. Goss
Micah M. Hines
BLACKWELL BURKE P.A.
431 South Seventh Street
Suite 2500
Minneapolis, Minnesota 55415

ALSO PRESENT:

Ryan M. Stirewalt, Videographer

EXAMINATION INDEX

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PROCEEDINGS

(Witness sworn.)

JOHN P. ABRAHAM, Ph.D.,

Called as a witness, being first duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. ASSAAD:

09:05:24 **Q.** Good morning.

09:05:24 **A.** Good morning.

09:05:26 **Q.** Please state your name.

09:05:27 **A.** John Patrick Abraham.

09:05:32 **Q.** And are you still a professor at St. Thomas?

09:05:34 **A.** Yes.

09:05:35 **Q.** Has anything changed with respect to your employment at St. Thomas since the last time we took your deposition?

09:05:42 **A.** No.

09:05:47 **Q.** I'm going to go over the instructions again. I'm sure you've heard it before, but just going to do it for the record.

I'm going to ask you numerous questions today. If you don't understand my question, please let me know. Is that fair?

09:05:58 **A.** Yes.

09:05:59 **Q.** If you answer the question that I have asked, I will assume that you understood the question. Fair enough?

09:06:03 **A.** Yes.

09:06:04 **Q.** If at any time you want to take a break, I just ask that you answer a pending question before you ask for a break. Fair enough?

09:06:12 **A.** Yes.

09:06:20 **Q.** Furthermore, I would like all your opinions to be within a reasonable degree of engineering certainty, therefore I don't -- if -- I want to try to avoid any guessing or any type of speculation. Do you understand?

09:06:34 **A.** Yes.

09:06:36 **Q.** And if you are going to guess or offer an estimate, just let us know beforehand that that's an approximation or an estimate and not an answer within a reasonable degree of engineering certainty. Fair enough?

09:06:46 **A.** Yes.

09:06:47 **Q.** Since our last deposition, have you been involved in any other depositions?

09:06:52 **A.** Yes.

09:06:54 **Q.** How many?

09:06:56 **A.** One.

09:06:57 **Q.** And what was that pertaining to?

09:07:00 **A.** It was pertaining to an International Trade Commission case related to a patent dispute.

09:07:11 **Q.** And who were the parties?

09:07:15 **A.** The complainant is iRobot. The respondents involved multiple parties, including Black & Decker, Hoover, Bissell, B-I-S-S-E-L-L, I think, and other -- there were other respondents as well.

09:07:36 **Q.** And who were you retained by?

09:07:38 **A.** Pillsbury. I believe it's Pillsbury Shaw Whitman out of Washington, D.C.

09:07:44 **Q.** And who did they represent?

09:07:47 **A.** They represented the respondents.

09:07:49 **Q.** All of them?

09:07:51 **A.** I don't believe so.

09:07:53 **Q.** Which ones, if you know?

09:07:54 **A.** The ones I mentioned. But there were multiple respondents, and I -- there were others that I -- I don't recall the names of.

09:08:02 **Q.** And what was your role in the case?

09:08:05 **A.** I was an --

I am an expert witness on the topic of patent infringement.

09:08:18 **Q.** Was your focus on any part of -- Well wha -- Strike that.

09:08:22 What was the device or the patent that was allegedly to be infringed?

09:08:24 **A.** Vacuum cleaners.

09:08:26 **Q.** When we talk about the iRobot, are you talking about those vacuums that just go along the floor automatically?

09:08:29 **A.** Yes.

09:08:33 **Q.** Okay. And did you focus on any particular aspect or patent in this litigation?

09:08:34 **A.** Yes.

09:08:35 **Q.** What was the patent regarding?

09:08:41 **A.** The patent was regarding the -- mainly the construction and components of the robots. The last numbers of the patents, the last three numbers are '090 and '233. I don't remember the full numbers of the patents.

09:08:45 **Q.** And when was your deposition in this case -- in that case?

09:08:49 **A.** December 2017.

09:08:54 **Q.** And was it here locally?

09:08:57 **A.** No.

09:09:01 **Q.** Was it in Washington, D.C.?

09:09:02 **A.** Yes.

09:09:05 **Q.** Is there anything in your field or in your expertise that was specific to the patent of -- that

09:09:42 involved the iRobot?
09:09:44 A. Yes.
09:09:44 Q. What?
09:09:46 A. The whole field of mechanical engineering,
09:09:49 which involves many disci -- subdisciplines, including
09:09:55 the manufacture, assembly and construction of the
09:10:00 robots, the sensors used by the robots, and the
09:10:06 airflow and particle accumulation performed by the
09:10:13 robots.
09:10:14 Q. Did you do any calculations with respect to
09:10:18 the airflow or to the particle accumulation with
09:10:20 respect to iRobot?
09:10:21 A. I did not.
09:10:23 Q. Did you perform any type of CFD analysis?
09:10:25 A. I did not.
09:10:36 Q. Do any of the patents deal with fluid
09:10:41 dynamics?
09:10:42 A. Yes.
09:10:43 Q. Which one, the '090, '233, or both?
09:10:47 A. Both.
09:10:56 Q. Did you offer any opinions in those cases
09:10:59 with respe -- or in that case with respect to particle
09:11:03 accumulation?
09:11:04 A. No.
09:11:05 Q. What about with respect to airflow?

09:11:07 A. No.
09:11:14 Q. Any other depositions between the last time
09:11:17 you and I met and today?
09:11:19 A. No.
09:11:21 Q. Are you involved in any other cases as an
09:11:23 expert witness that is not listed on your CV?
09:11:32 A. I don't believe so. I don't know how
09:11:33 current that CV is, if -- but I don't believe there
09:11:37 are any others.
09:11:40 Q. Are you still a consultant for 3M?
09:11:44 A. I'm not a consultant for 3M.
09:11:50 Q. Well on -- on your CV you state from 2015 to
09:11:55 2017, under the title "CONSULTANTSHIPS" you have "3M."
09:12:01 A. Right. And that is no longer -- I'm no
09:12:03 longer a consultant for 3M.
09:12:05 Q. When did that terminate?
09:12:06 A. According to the -- my CV, that was finished
09:12:10 in 2017.
09:12:11 Q. At what point in 2017?
09:12:15 A. I would estimate around June or -- June.
09:12:19 Q. Okay. And what type of consulting were you
09:12:22 doing for 3M up till June?
09:12:24 A. It was related to the grants associated with
09:12:28 the simulation for this case.
09:12:30 Q. Okay. And we're talking about the two

09:12:38 grants, the one for $12,000 and other for $14,000;
09:12:41 correct?
09:12:42 A. That's correct.
09:12:59 Q. Are you involved in any other cases that
09:13:01 deal with -- when I say "cases," litigation cases --
09:13:07 that deal with fluid dynamics or computational fluid
09:13:13 dynamics?
09:13:20 A. No cases that deal with computational fluid
09:13:23 dynamics.
09:13:24 Q. Okay. What about with just fluid dynamics?
09:13:28 A. Well insofar as I'm involved in some cases
09:13:31 related to burn injuries that involve spills of hot
09:13:34 liquids, then yes.
09:13:36 Q. Okay. You understand that you've been
09:13:44 designated as an expert witness on behalf of 3M in the
09:13:49 Gareis case.
09:13:51 A. Yes.
09:13:52 Q. And you understand, as an expert witness,
09:13:54 you should be objective.
09:13:56 A. Yes.
09:13:57 Q. You should not be an advocate for either
09:14:00 side; correct?
09:14:01 A. Yes.
09:14:16 Q. You understand, as a professor of
09:14:17 engineering as well as an expert, that providing false

09:14:21 data or results would be considered fraudulent.
09:14:26 A. Yes.
09:14:29 Q. And providing false data or results in any
09:14:33 type of report or publication would be considered
09:14:38 research fraud.
09:14:40 MR. GOSS: Object to form.
09:14:42 Q. Do you agree with that?
09:14:44 A. Usually research fraud is used in the
09:14:46 context of scholarly work, published work. So unless
09:14:53 there's a specific definition of research fraud that
09:14:55 you'd like to give, I don't know if I can answer that.
09:14:59 Q. How would you define "research fraud"?
09:15:02 A. Well I would define it through example. If
09:15:08 you fabricated results and then published those
09:15:10 results as a scholarly article, I would call that
09:15:14 research fraud.
09:15:22 Q. Would you consider leaving results that do
09:15:27 not support your position out of the paper, research
09:15:30 fraud?
09:15:34 A. If they were contrary to your conclusion,
09:15:39 then yes.
09:15:49 Q. You understand that you're under oath today;
09:15:51 correct?
09:15:52 A. Yes.
09:15:52 Q. And that's under a penal --

When you're under oath you're under a penalty of perjury. Do you understand that?

A. Yes.

Q. And you understand that my goal here today is to understand the full scope of your opinions.

A. Yes.

MR. GOSS: In the Gareis case; correct? The opinions he will offer at trial on the Gareis matter.

MR. ASSAAD: Yes.

MR. GOSS: Okay.

Q. And to understand all the methodologies on how you reached your opinions. Do you understand that? That's one of the goals here today.

A. Yes.

Q. Would it be accurate to summarize your entire opinion as saying that it is your opinion that the Bair Hugger 505 does not disrupt the unidirectional airflow?

MR. GOSS: Object to form.

A. That is one opinion.

Q. In forming your conclusions or your opinions, you relied on -- on data that is reliable; correct?

A. That's a cumbersome question, but I would

say this. I believe my data are reliable. My opinion is my data's reliable.

Q. Okay. I mean, your opinion is based on reliable data; correct?

A. Anything that went into forming my opinion, I understand to be reliable.

Q. You would not rely on unreliable data in formulating your opinion; correct?

A. Correct.

Q. And you wouldn't refer to a article or to data that you believed was unreliable.

A. What does "referred" mean?

Q. In a citation, for example, in your paper, or to data in your expert report.

A. That's not true.

Q. You would refer to unreliable data?

A. If someone else has an alternative explanation which I disagree with, I would reference it, and it's my obligation to say why I disagree with it.

Q. I understand that.

Maybe I should ask the question this way: You wouldn't refer to unreliable data to support your opinion or your conclusions.

A. If I had unreliable data that didn't support

my opinion or conclusions, I would try to explain why I think it's unreliable. I wouldn't ignore anything that I felt was unreliable.

Q. I think you misunderstood my question a little bit, and maybe it was not a articulate question.

You wouldn't rely on data to support your opinions if you know that the data is unreliable.

A. I mean, it depends. It depends on what do you mean by "unreliable"? Is unreliable something that I -- isn't validated? Is the data part of a broader collection of data and I'm...

When you look at a result and -- or you have a conclusion you look for other evidence that supports or refutes your opinions. And that supporting information may come from all kinds of places; some of it may be reliable, some of it may not be reliable. I think it's important to distinguish the two and not -- I wouldn't throw away data that is unreliable just because it's unreliable.

Q. For example, if you were doing research and the data that you rely -- were relying upon; say, for example, airflow data, and it was discovered that the instrument to collect that airflow data was not calibrated properly, would you agree with me that you

would not use that data or refer to that data to support your research?

A. I disagree.

What I would do, if I used data that was collected by a non-calibrated instrument, for instance, and if I relied on that data, I would acknowledge that there's some uncertainty in the input, and that da -- and the uncertainty is the data was collected by a non-calibrated instrument.

But we have many instances, in fact it's more likely than not that a non-calibrated instrument's still going to give you the right results. But it's important to acknowledge uncertainty. You don't just throw things away because an instrument's uncalibrated. It goes to the weight that you give that information.

Q. But you would definitely acknowledge the limitation or the uncertainty.

A. If there was a limitation or an uncertainty that was important to the conclusion, so I'm talking about something that's nonnegligible, then yes.

Q. Yes, you would acknowledge it.

A. Yes.

Q. You reviewed your report for accuracy before today's deposition?

09:22:04 **A.** Yes.
09:22:05 **Q.** Any changes you'd like to make to your
09:22:07 report before we begin?
09:22:09 **A.** Not at this time.
09:22:12 **Q.** At any time?
09:22:12 **A.** Well if -- if I discover something today
09:22:15 that's not correct, then I'll make changes. But
09:22:18 there's no changes that I -- There's no errors in the
09:22:21 report that I'm aware of now.
09:22:23 **Q.** Have you received Dr. Elghobashi's report?
09:22:28 **A.** Yes.
09:22:29 **Q.** Have you received his data and his
09:22:33 PowerPoint, which include the graphs and the videos?
09:22:36 **A.** I have not received his data. I have
09:22:38 received a PowerPoint.
09:22:39 **Q.** Okay. And the Power -- What about his
09:22:44 calculations -- Strike that.
09:22:50 What have you received recently from Dr.
09:22:56 Elghobashi?
09:22:58 **A.** Via counsel I have received some
09:23:02 PowerPoints, there were some OR photos which I think I
09:23:07 had already seen, and there was a report. And that's
09:23:11 all I can recall right now.
09:23:14 **Q.** The report --
09:23:15 His original report, or was it a supplement

09:23:17 to his report?
09:23:18 **A.** The report related to the Gareis case.
09:23:21 **Q.** Okay. And when did you see -- receive the
09:23:25 PowerPoint?
09:23:27 **A.** I don't recall the date. I mean, it was
09:23:29 recent, but I don't recall.
09:23:30 **Q.** Have you reviewed them?
09:23:31 **A.** Yes.
09:23:32 **Q.** And did the PowerPoint contain graphs that
09:23:36 discussed squame cell deposits in certain areas of the
09:23:41 operating room?
09:23:42 **A.** I be --
09:23:42 If I recall correctly, yes, there were --
09:23:44 was a graph or graphs.
09:23:46 **Q.** And did it also contain the videos of
09:23:49 particles moving in the operating room?
09:23:53 **A.** You know, I don't recall if there was a
09:23:54 video of part...
09:23:55 I don't recall if that video was embedded.
09:23:59 **Q.** Were there videos?
09:24:00 **A.** Yes.
09:24:00 **Q.** Okay. And you've had a chance to review
09:24:06 those documents; correct?
09:24:07 **A.** Yes.
09:24:07 **Q.** Are you ready to discuss them today?

09:24:09 **A.** Yes.
09:24:10 **Q.** Is there anything else that you would need
09:24:13 or is missing from Dr. Elghobashi to discuss today?
09:24:18 **A.** Well for a complete discussion, yes, there
09:24:20 is.
09:24:21 **Q.** What --
09:24:21 **A.** I can dis --
09:24:22 What I am prepared to discuss is the
09:24:25 information that he provided in his PowerPoint and in
09:24:27 his supplemental report, but none of the data was
09:24:31 actually ever provided, nor was the code provided.
09:24:36 **Q.** To you.
09:24:36 **A.** That's correct.
09:24:37 **Q.** Okay. Based on the review of Dr.
09:24:58 Elghobashi's report and the PowerPoint that contains
09:25:00 the graph and videos, are there any changes that you
09:25:03 would like to make to your report?
09:25:05 **A.** None.
09:25:32 **Q.** You stand by your report?
09:25:34 **A.** Yes.
09:25:36 MR. GOSS: We're talking about the Gareis
09:25:38 report?
09:25:38 MR. ASSAAD: Yes.
09:25:40 MR. GOSS: I mean, or -- or both reports.
09:25:41 MR. ASSAAD: I'll address that.

09:25:41 BY MR. ASSAAD:
09:25:43 **Q.** Have you changed your position on your
09:25:44 general causation report?
09:25:46 **A.** No.
09:25:47 **Q.** Okay.
09:25:48 MR. GOSS: Just to be clear.
09:26:02 **Q.** Are there any other opinions that you would
09:26:03 like to add to your report before we begin?
09:26:14 **A.** Yes.
09:26:14 **Q.** What?
09:26:19 **A.** I believe Elghobashi stated at his
09:26:24 deposition that the elevated return vent on the wall
09:26:31 in the Providence OR -- and I'm using the term
09:26:34 "Providence OR" because I think it was the Providence
09:26:40 Hospital -- he opined that that would make it more
09:26:42 likely Bair Hugger air would intrude into the
09:26:47 operating theater, and I disagree with that.
09:26:54 **Q.** Anything else?
09:27:16 **A.** Not at this... No.
09:27:22 Hmm. Yes.
09:27:24 **Q.** Hold on one second, please, while I write
09:27:26 this down.
09:27:36 Before you get to that opinion. Are you
09:27:38 saying that you disagree that the Bair Hugger would
09:27:40 allow more particles into the operating theater, or

09:27:44 over the sterile field, or both?
09:27:52 **A.** Let me just restate it. Maybe I can make it clearer.
09:27:55 It's my --
09:27:55 **Q.** You really going to make me cross out what I just wrote down?
09:28:00
09:28:01 **A.** I might.
09:28:01 **Q.** Fair enough.
09:28:02 **A.** It is my understanding, at his deposition, that Dr. Elghobashi gave an opinion that the elevated exhaust vent in the Providence OR would make it easier for Bair Hugger air to get over the operating table. Now operating theater/surgical site, I'll lump those together as above the operating table.
09:28:06
09:28:13
09:28:18
09:28:24
09:28:29
09:28:31 **Q.** Okay.
09:28:31 **A.** I disagree with that opinion.
09:28:34 **Q.** Fair enough.
09:28:34 That's what I wanted to clarify, because you mentioned "operating theater," and I don't think Dr. Elghobashi opined that the Bair Hugger actually creates more particles out of nothing, it was where the particles would go. So you're saying over the operating table.
09:28:37
09:28:42
09:28:45
09:28:50
09:28:52
09:28:52 **A.** Well I'm not --
09:28:54 I don't know if I used the word particles in

09:28:55 my answer. I'm talking about the airflow.
09:28:58 **Q.** Okay.
09:29:01 **A.** In summary, he thinks the elevated vent would make it easier for Bair Hugger air to travel, and I disagree.
09:29:05
09:29:08
09:29:10 **Q.** Okay. And what is your other opinion?
09:29:14 **A.** I think my other opinion was actually in my sup -- my report, so I don't need to make a modification.
09:29:17
09:29:19
09:29:20 **Q.** And which opinion is that referring to?
09:29:22 **A.** It was related to the positioning of the ceiling vents in the Providence OR.
09:29:25
09:29:36 **Q.** You consider yourself ethical; correct?
09:29:39 **A.** Yes.
09:29:41 **Q.** As an engineer; correct?
09:29:42 **A.** I am an engineer and I consider myself ethical.
09:29:44
09:29:45 **Q.** An ethical engineer?
09:29:46 **A.** Well I am ethical, and I am an engineer, so yes, an ethical engineer.
09:29:49
09:29:51 **Q.** Do you consider yourself an ethical author of publications?
09:29:53
09:29:54 **A.** Yes.
09:29:55 **Q.** Do you consider yourself an ethical scientist?
09:29:57

09:29:59 **A.** Yes.
09:30:15 **Q.** Are you a reviewer for any journals?
09:30:19 **A.** Yes.
09:30:19 **Q.** What journals?
09:30:21 **A.** Too many to count. I mean, many. I get review requests weekly.
09:30:24
09:30:27 **Q.** Any --
09:30:28 Can you just give me a list of the main journals?
09:30:32
09:30:38 **A.** I don't think I can. I mean, there's so many. I have probably reviewed for over a hundred journals, so. I got a review request today for a, like a mathematical and applied physics journal paper today.
09:30:39
09:30:42
09:30:50
09:30:54
09:30:55 I don't list review activities in my CV because they are trivial, and they're a service, not a publica -- not a -- they're not scholarly productivity. I consider them a service.
09:30:58
09:31:03
09:31:11
09:31:14 **Q.** Fair enough.
09:31:32 For example, do you review for*Atmospheric and Oceanic Science Letters*?
09:31:36
09:31:38 **A.** I think I have, but I can't say for sure.
09:31:41 **Q.** What about the*Journal of Biomedical Science and Engineering*?
09:31:45
09:31:46 **A.** I believe I have reviewed for that journal.

09:31:49 **Q.** What about*Numerical Heat Transfer*?
09:31:53 **A.** I don't know if I've reviewed for that journal.
09:31:54
09:31:57 **Q.** And would that include Part A?
09:31:59 **A.** Correct.
09:32:03 **Q.** What about the*International Journal of Heat and Mass Transfer*?
09:32:05
09:32:06 **A.** I have reviewed for that journal.
09:32:11 **Q.** What about for theJournal of Medical Devices?
09:32:13
09:32:15 **A.** I don't recall.
09:32:28 **Q.** What about the journal for -- of *International Communications in Heat and Mass Transfer*?
09:32:30
09:32:33
09:32:33 **A.** I believe I have reviewed for that journal.
09:32:36 **Q.** What about Frontiers in Heat Transfer?
09:32:40 **A.** I don't recall reviewing for that journal.
09:32:58 **Q.** Now when you perform research or act as a consultant you expect others to -- you put out a product; correct? A paper -- A paper or some -- or a memo, depending on the type of job you're doing; correct?
09:33:01
09:33:04
09:33:09
09:33:12
09:33:12 **A.** Typically, yes.
09:33:14 **Q.** And you expect others to review the work that you put out; correct?
09:33:18

09:33:21 **A.** Will I expect others to read it, if it's an
09:33:24 article or a -- a memo? So insofar as if it's a memo,
09:33:31 let's say, that goes to a company, then I would expect
09:33:34 someone to read it. Whether you call that a review, I
09:33:36 don't -- I don't know if I would call that a review.
09:33:38 **Q.** That's what I meant by "review," like read
09:33:40 it, look at it.
09:33:41 **A.** I would expect my product -- my -- whatever
09:33:43 I produce is reviewed.
09:33:44 **Q.** And when you act as a consultant, the
09:33:47 companies that you consult for rely on your data or
09:33:53 work product.
09:33:54 **A.** That is true.
09:33:56 **Q.** And they rely on your conclusions; correct?
09:33:58 MR. GOSS: Object to form, foundation.
09:34:01 **A.** That may be true.
09:34:03 **Q.** And in some cases your results -- your
09:34:06 results or your research is used to market products.
09:34:11 **A.** Yes.
09:34:14 **Q.** For example, 3M uses your work in this case
09:34:19 to market the Bair Hugger and discuss their perception
09:34:27 of the safety of Bair Hugger.
09:34:29 **A.** I don't --
09:34:30 MR. GOSS: Object to form.
09:34:31 **A.** I don't know if that's true.

09:34:32 **Q.** Do you understand that your streamline
09:34:36 videos are on 3M websites?
09:34:38 **A.** I don't know that.
09:34:42 **Q.** Have you ever typed your name into Google
09:34:44 and type in "John Abraham" and "Bair Hugger"?
09:34:48 **A.** I don't recall ever typing in John Abraham
09:34:50 and Bair Hugger.
09:34:59 **Q.** Have you reviewed any depositions in
09:35:02 preparation of your deposition today?
09:35:04 **A.** Yes.
09:35:05 **Q.** Besides Dr. Elghobashi, any others?
09:35:07 **A.** Yes.
09:35:08 **Q.** What depositions?
09:35:10 **A.** Rauch, R-A-U-C-H, is the last name.
09:35:14 **Q.** Umm-hmm. Any others?
09:35:16 **A.** No.
09:35:19 **Q.** Have you reviewed any expert reports in
09:35:22 preparation of your opinions in this case?
09:35:24 **A.** Yes.
09:35:25 **Q.** What expert reports?
09:35:28 **A.** The expert report from Elghobashi.
09:35:31 **Q.** Any others?
09:35:33 **A.** No.
09:35:34 **Q.** Have you reviewed the expert report of Dr.
09:35:37 Stonnington?

09:35:38 **A.** No.
09:35:38 **Q.** Have you read the deposition of Dr.
09:35:40 Stonnington?
09:35:41 **A.** No.
09:35:42 **Q.** Have you read the expert report of Dr.
09:35:48 Jarvis?
09:35:49 **A.** No.
09:35:51 **Q.** Have you read the deposition of Dr. Jarvis?
09:35:53 **A.** No.
09:35:56 **Q.** With respect to defendant's experts, have
09:35:59 you reviewed the expert report of Mr. Keen?
09:36:03 **A.** No.
09:36:04 **Q.** Have you read the deposition of Mr. Keen?
09:36:06 **A.** No.
09:36:07 **Q.** Have you reviewed the expert report of Dr.
09:36:10 Wenzel?
09:36:11 **A.** No.
09:36:12 **Q.** Have you seen his deposi --
09:36:16 Have you reviewed his deposition, Dr.
09:36:18 Wenzel's?
09:36:18 **A.** No.
09:36:22 **Q.** Have you been provided the report of Dr.
09:36:25 Mont?
09:36:26 **A.** No.
09:36:28 **Q.** Have you reviewed his -- the deposition of

09:36:30 Dr. Mont?
09:36:31 **A.** No.
09:36:49 **Q.** Have you reviewed the deposition -- Or
09:36:51 strike that.
09:36:52 Have you been provided the report of Dr.
09:36:55 Borak?
09:36:56 **A.** No.
09:36:57 **Q.** Have you reviewed the deposition of Dr.
09:36:58 Borak?
09:36:59 **A.** No.
09:37:00 **Q.** Have you been provided the report of Dr. --
09:37:03 strike that -- of Ms. Hughes?
09:37:06 **A.** No.
09:37:07 **Q.** Have you read the deposition of Ms. Hughes?
09:37:09 **A.** No.
09:37:12 MR. GOSS: You almost got him there.
09:37:50 **Q.** Have you performed any experiments with
09:37:54 respect to the Gareis case?
09:37:56 **A.** No.
09:38:00 **Q.** Are you preparing or submitting any
09:38:02 manuscripts with respect to the Gareis case?
09:38:05 **A.** No.
09:38:05 **Q.** Are you submitting any manuscripts with
09:38:07 respect to the 505?
09:38:10 **A.** No.

09:38:11 **Q.** When I say "505" you understand it to mean
09:38:13 the Bair Hugger Model 505.
09:38:15 **A.** Yes.
09:38:15 (Abraham Exhibit 1 marked for
09:38:15 identification.)
09:38:15 BY MR. ASSAAD:
09:38:40 **Q.** What's been marked as Exhibit 1 is titled
09:38:44 "Case-Specific Report in Gareis versus 3M and Response
09:38:48 to Supplemental Report of Dr. Said Elghobashi," dated
09:38:53 December 18th, 2017.
09:38:56 Do you recognize this -- this document,
09:39:00 Exhibit 1?
09:39:02 **A.** Yes, I do.
09:39:03 **Q.** Is this a complete copy of your expert
09:39:07 report submitted in this case?
09:39:10 **A.** Yes, it is.
09:39:18 **Q.** And it's my understanding that this report
09:39:20 deals with the Bair Hugger Model 505; correct?
09:39:27 **A.** That's correct.
09:39:28 **Q.** And this is the result of a grant provided
09:39:32 to you for the amount of $14,000 by 3M; correct?
09:39:37 **A.** Correct.
09:39:46 **Q.** And it's my understanding that you ran the
09:39:56 model for the 505 until you've obtained quasi-steady
09:40:01 results; correct?

09:40:02 **A.** Yes.
09:40:03 **Q.** What is your definition of "quasi-steady"?
09:40:07 **A.** When the flow patterns are not meaningfully
09:40:11 changing over time.
09:40:18 **Q.** And when you say flow -- Well strike that.
09:40:20 How do you define the word "meaningfully"?
09:40:24 **A.** Enough to affect the conclusions.
09:40:27 **Q.** Is there a percentage that you're looking
09:40:28 at?
09:40:29 **A.** No.
09:40:31 **Q.** So when you say "affect the conclusions,"
09:40:35 what do you mean "affect the conclusions"?
09:40:37 **A.** Well in this case I looked at the flow
09:40:43 patterns --
09:40:43 **Q.** I don't mean to stop you. I don't -- I'm
09:40:46 talking about generally. I don't want to --
09:40:49 I'm trying to get the definition generally,
09:40:51 not with respect to this case. Is that fair enough?
09:40:53 You understand?
09:40:54 **A.** Okay. Yes.
09:40:57 **Q.** So how would you define a meaningful -- a
09:41:04 non-meaningful change that does not affect the
09:41:06 conclusions?
09:41:14 **A.** If a change would affect the conclusions,
09:41:16 that would be a meaningful change.

09:41:37 **Q.** With respect to computational fluid
09:41:40 dynamics, when you use the term quasi-steady and
09:41:42 you're looking for a meaningful change, what are you
09:41:45 looking at exactly; what data?
09:41:49 **A.** Well what I was looking at was the pattern
09:41:51 of airflow, which I represent by the streamlines. So
09:41:57 what I did was something very similar to what Said
09:42:00 Elghobashi did. He used the term steady-state plumes,
09:42:07 and that's equivalent to -- he may have used the term
09:42:10 just steady state, and that is when the flow patterns
09:42:17 are not meaningfully changing over time.
09:42:23 **Q.** So you're looking at the streamlines.
09:42:25 **A.** Yes.
09:42:26 **Q.** Are you looking at temperature?
09:42:33 **A.** I used the streamlines to demonstrate
09:42:37 quasi-steady flow.
09:42:39 **Q.** I understand that. Did you look at --
09:42:42 Do you look at temperature as well to
09:42:43 determine quasi-steady?
09:42:45 **A.** I looked at temperature, but I used the
09:42:47 streamlines to determine quasi-steady.
09:42:50 **Q.** Okay. So just so I understand you, in your
09:43:03 505 report you only looked at streamlines to determine
09:43:09 whether or not the results were quasi-steady.
09:43:13 **A.** That is correct.

09:43:16 **Q.** To determine quasi-steady you did not look
09:43:19 at the temperature; correct?
09:43:20 **A.** Correct.
09:43:21 **Q.** To determine quasi-steady you did not look
09:43:24 at the velocity of the air; correct?
09:43:30 **A.** Incorrect.
09:43:30 MR. GOSS: Object to form.
09:43:31 **Q.** You looked at the vel -- the actual velocity
09:43:33 -- not the vector, but the velocity.
09:43:35 **A.** Well insofar as the streamlines are made
09:43:38 from the vectors, from the velocity, yes, I did use
09:43:41 the velocity.
09:43:42 **Q.** Okay. Did you look at turbulence -- Strike
09:44:00 that.
09:44:00 To determine quasi-steady flow you did not
09:44:05 look at turbulence intensity; correct?
09:44:07 **A.** Correct.
09:44:20 **Q.** And over what period of time do you look for
09:44:29 a change?
09:44:33 **A.** I -- I think I used 60 seconds. So the
09:44:40 patterns of flow for 60 seconds.
09:44:49 **Q.** Is that somewhere in your report?
09:44:51 **A.** No. I don't think I listed that in my
09:44:53 report.
09:45:15 **Q.** And I assume that the 60 seconds was based

09:45:20 off the TRN file labeled 2540.TRN?
09:45:30 **A.** No.
09:45:30 **Q.** What was it off of?
09:45:31 **A.** I used 60 seconds because I believe that is what Elghobashi had claimed. He opined that within approximately 60 seconds particles would be deposited in the surgical site.
09:45:47 **Q.** Okay. So --
09:45:48 **A.** I wanted to know, is that true.
09:45:50 **Q.** My question is: Sixty seconds of streamline time, or 60 seconds of simulation time?
09:45:58 **A.** The 60 seconds refers to the period that I'm tracking the airflow, so I'm tracking the airflow for 60 seconds. It is not simulation time.
09:46:04 **Q.** Okay. So you're tracking the streamline for 60 seconds.
09:46:16 **A.** That's right.
09:46:18 **Q.** It is not 60 seconds of simulation time.
09:46:19 **A.** That is correct.
09:46:20 **Q.** And the 60 seconds of streamline tracking, is that based off the results in the 2540 TRN file?
09:46:23 **A.** Yes.
09:46:24 **Q.** No other TRN file was used to determine your quasi-steady?
09:46:34 **A.** No, that's not true.

09:46:40 **Q.** You used other TRN files?
09:46:41 **A.** Yes.
09:46:43 **Q.** Which ones?
09:46:44 **A.** Well I used many, and the whole point is to show that they don't meaningfully change over time. And then once you show that you've reached quasi-steady you show the results. And it doesn't matter which one you pick as long as you are quasi-steady.
09:46:45 MR. ASSAAD: Let's take a break.
09:46:49 THE REPORTER: Off the record, please.
09:46:52 (Recess taken from 9:47 to 9:54 a.m.)
09:46:53 BY MR. ASSAAD:
09:46:57 **Q.** We were talking about quasi-steady and that you only looked at streamlines to determine quasi-steady flow; correct?
09:46:59 **A.** Correct.
09:47:44 **Q.** And you mentioned that you looked at it for 60 seconds; correct?
09:47:47 **A.** Correct.
09:47:49 **Q.** Why only 60 seconds?
09:54:46 **A.** Because I recalled that was the time period Elghobashi used in his report. He opined that within 60 seconds or so the Bair Hugger particles, as he described them, would reach the surgical site.
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09:55:25 **Q.** Okay. But you also used -- Did you -- Strike that.
09:55:32 Did you use 60 seconds with respect to your general causation report?
09:55:32 **A.** I don't recall what I used with respect to my general causation report.
09:55:35 **Q.** Okay. You agree that temperature can affect airflow; correct?
09:55:39 **A.** Temperature can affect airflow.
09:55:41 **Q.** You agree that turbulence can affect airflow; correct?
09:55:43 **A.** I agree turbulence can affect airflow.
09:55:59 **Q.** Now how do you determine that there is -- when you're looking at the streamlines, that there's no meaningful change?
09:56:01 **A.** Well what I do is I look to see if the streamlines from underneath the table or the Bair Hugger came anywhere near the operating theater or the surgical site, and if they haven't come anywhere near, and if any changes still don't bring them anywhere near, then it's not meaningful change.
09:56:03 **Q.** Okay. So your definition of quasi-steady state in this case is that you do not see any streamlines going over the operating room table.
09:56:05 MR. GOSS: Object to form.
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09:57:09 **A.** No. That's not what I said my definition was.
09:57:12 **Q.** So my understanding is when you look at streamlines to determine whether or not there is any meaningful change to determine quasi-steady, you're looking at the streamlines from underneath the table or the Bair Hugger and whether they come near the operating theater or the surgical site. Is that correct?
09:57:30 **A.** I don't think that was my full answer.
09:57:32 Maybe I could just answer it again and make it clearer.
09:57:36 **Q.** Maybe. That's a good...
09:57:42 So when you're looking at the streamlines to determine whether or not there is quasi-steady, hence there's no meaningful change, what are you looking at?
09:57:44 **A.** I'm looking to see are the streamlines changing in time in a way that will bring them to -- well are they changing meaningfully in time. And since the report that I wrote, and I believe in Elghobashi's supplemental report he opined 60 seconds, up to 60 seconds would be needed, and it's my understanding that, maybe it was at his deposition or -- I recall now 43 seconds, so he shortened his time period.
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So if I were to do this again I would track streamlines for 43 seconds and I would look at them and I would see are they changing meaningfully, and are they near the surgical site.

Q. Okay. From a CFD technical standpoint, what is the process that you do to determine whether or not the streamlines are changing meaningfully?

A. It's what I just described. You consider -- You look at the patterns of the streamlines, so for in this -- It comes down to what question you're trying to answer. The question I'm trying to answer is does the Bair Hugger bring air, its -- does its air travel to the surgical site and is Elghobashi correct. Elghobashi reports that within 43 seconds the air gets there. Okay. Now I didn't have that information of 43 seconds when I wrote this, so I went extra, I went 60 seconds.

But my answer is: Within 43 seconds are the patterns of streamlines, A, close to the surgical site; B, are they changing in a way that will bring them to the surgical site. And the answer to both of those were no -- was -- is no.

Q. Now when you say "the air from the Bair Hugger," are you talking about the exhaust air out of the blanket?

A. In my case I actually modeled two different airstreams, because there's some conflicting accusations about whether it's air from the Bair Hugger or whether it's Bair Hugger heat might take air from beneath the table and bring that to the surgical site. So those are two conflicting propositions. I investigated both. I looked at air from beneath the surgical table and air from the Bair Hugger itself.

Q. Okay. So the two scenarios you looked at was from air from the Bair Hugger, and that would be the exhaust air from the Bair Hugger; correct?

A. That is correct.

Q. Okay. And the second one you looked at was from just air underneath the operating room table.

A. That is correct.

Q. Any specific point underneath the operating room table?

A. I recall it was a -- a region, and I think it was a meter in diameter but I can't recall the actual si -- I can't recall the specific size, but it was a -- it was a zone underneath the table.

Q. Was it underneath the head or the -- or the --

A. It was near the center --

Well it would have -- couldn't have just

been underneath the head because it was larger than the head. I don't recall exactly where that sphere was, but it was a large sphere.

Q. Okay. So you have the operating room table and you have the post or the stand that raises it from the floor; correct?

A. Correct.

Q. Okay. Was it towards -- that zone towards the head, from that point towards the head of -- of the patient, or from that post to behind to the feet of the patient?

A. I don't recall it being predisposed either toward the head or the feet. It was probably more centrally located, but I just don't recall the exact location sitting here.

Q. Was the zone that you created, was it a zone in the -- if the Y axis is height, was it within the Y axis or was it within the X and Z axis?

A. It would have been all three.

Q. All three.

A. It would have been a three-dimensional zone.

Q. Three-dimensional zone.

And would that zone be somewhere on your 2540 TRN file?

A. I don't know.

Q. And when you create these streamlines, how do you create them in ANSYS? Which is the software you used; correct?

A. Correct.

You create them by identifying a starting location, where they begin, and a track duration.

Q. A starting location and a track duration.

A. Right. So how long do you track them.

Q. And in this case that's 60 seconds.

A. Yes.

Q. So would it be fair and accurate to state that you only looked at the first 60 seconds of a streamline; correct?

A. Well beyond -- I mean -- These --

These software programs are not indefinitely predictive, okay. So you can only use them to predict flow for a certain time period. I used 60 seconds because that was what was opined by Elghobashi as the time it took.

Now it turns out he revised that expectation and I believe his new time period is 43 seconds. So if I were to do it again I would track the flow for 43 seconds.

Q. So the purpose of your report was to prove that Dr. Elghobashi was incorrect.

10:05:34 **A.** No.
10:05:35 MR. GOSS: Object to form.
10:05:36 **A.** I disagree.
10:05:37 **Q.** Then why not use two minutes, or three
10:05:39 minutes, or some other time?
10:05:44 **A.** Because C -- CFD is like weather prediction.
10:05:50 It's valid for a certain time period, but you can't
10:05:53 extend it indefinitely. Weather predictions are good
10:06:00 for about seven days, but weather predictions are not
10:06:04 good a year from now.
10:06:05 So you cannot project a result beyond the
10:06:10 capacity of the solution, and that's why I wouldn't
10:06:16 want to use longer time periods.
10:06:20 What I wanted to do is say, well here's an
10:06:22 idea that these particles get here in 60 seconds. Is
10:06:28 that true or not? My purpose was not to show he was
10:06:31 incorrect, my purpose was to see if he was correct.
10:06:38 **Q.** And it's your opinion that Dr. Elghobashi
10:06:41 was not correct.
10:06:42 **A.** I --
10:06:43 It's my opinion he is incorrect.
10:06:45 **Q.** Okay. So would it be fair to say that when
10:07:04 you performed your CFD analysis that your null
10:07:08 hypothesis was that Dr. Elghobashi was correct?
10:07:14 MR. GOSS: Are we saying for the 2540 --

10:07:16 MR. ASSAAD: Yes.
10:07:17 MR. GOSS: -- 505?
10:07:21 **A.** I was agnostic about whether he is correct
10:07:24 or incorrect. Now --
10:07:27 **Q.** What was your --
10:07:29 Sorry. Go ahead.
10:07:29 **A.** That was it.
10:07:30 **Q.** I was going to ask you what was your null
10:07:32 hypothesis, if you had one?
10:07:34 **A.** I did not have one.
10:07:36 **Q.** Okay. Now it is my understanding that the
10:07:56 2540.TRN file was created prior to your first
10:08:01 deposition; correct?
10:08:03 **A.** That is correct.
10:08:04 **Q.** Okay. When you created your report in this
10:08:07 case did you go back to the file and do more -- create
10:08:14 more streamlines?
10:08:16 **A.** I went back to the file and created more
10:08:18 streamlines, and I don't know if it was before or
10:08:20 after this report.
10:08:23 **Q.** Okay. You do agree that when Dr. Elghobashi
10:08:27 came up with his report that said that the particles
10:08:30 will get there between 25 to 60 seconds, that was
10:08:34 after you created your 2540.TRN file.
10:08:39 **A.** That is correct.

10:08:39 (Ms. Zimmerman joined the proceedings.)
10:08:40 **Q.** Okay. So did you use the 60 seconds of
10:08:42 streamlines prior to Dr. Elghobashi's report, or after
10:08:50 Dr. Elghobashi's report in this case?
10:08:54 **A.** I don't re --
10:08:55 I don't know for sure. It may well have
10:08:57 been after. I don't -- I don't recall when.
10:09:10 **Q.** Okay. Looking at Exhibit 1, Figure 3, page
10:09:36 4. We see three sets of streamlines there; correct?
10:09:45 **A.** Correct.
10:09:46 **Q.** Do you know the time that each picture is?
10:09:55 **A.** So this is one of those times, you gave me
10:09:58 instructions initially to let you know if I was
10:10:01 estimating.
10:10:02 **Q.** Yes.
10:10:02 **A.** I don't know for sure. I wouldn't say that
10:10:05 I know with a reasonable degree of engineering
10:10:08 certainty, but I think they were one -- No, I don't --
10:10:12 I don't know for sure, but they were -- I don't know.
10:10:15 **Q.** Okay. The last one on the bottom, would
10:10:17 that be the 60-second streamline?
10:10:20 **A.** No.
10:10:22 **Q.** Okay. Would it be less than 60 seconds?
10:10:24 **A.** Yes.
10:10:31 **Q.** Are there any diagrams or figures that show

10:10:37 the streamlines at 60 seconds -- that ran for 60
10:10:40 seconds, in your report?
10:10:45 **A.** I don't believe they are in my report.
10:10:46 **Q.** Okay.
10:10:47 **A.** We have Figures 6 and 8, and I don't recall
10:10:49 how long those streamlines are tracked.
10:11:36 **Q.** With respect to the determination of
10:11:39 quasi-steady, when you talk about a change in
10:11:44 streamlines are you comparing the streamlines between
10:11:58 different TRN files?
10:12:06 **A.** Yes.
10:12:08 **Q.** And you did that in this case.
10:12:09 **A.** Yes.
10:12:14 **Q.** And it's your opinion that none of the
10:12:17 streamlines ended up over the operating room table;
10:12:25 correct?
10:12:30 **A.** It is my opinion --
10:12:33 So I -- I tracked the streamlines for 60
10:12:35 seconds, because that was the longest period that
10:12:39 Elghobashi stated in his supplemental report, and I
10:12:43 found no evidence that any -- at any time period any
10:12:49 of those streamlines would be at the surgical site.
10:12:54 **Q.** So it's your opinion that the Bair Hugger
10:12:58 does not change airflow to cause any streamlines from
10:13:04 the exhaust of the Bair Hugger or underneath the

operating room table to go over the surgical site.
MR. GOSS: Object to form.
MR. ASSAAD: Basis?
MR. GOSS: I think the basis is that mischaracterizes his testimony, because he gave a timeframe.
Q. In 60 seconds.
MR. GOSS: There you go.
A. Yes.
Actually could we read the question back? Just -- I want to make sure what I said "yes" to.
Q. Let me break it apart.
It is your opinion that the Bair Hugger does not change airflow to cause any streamlines from the exhaust of the Bair Hugger to go over the surgical site within 60 seconds.
A. Correct.
Q. It is also your opinion that the Bair Hugger does not change airflow to cause any streamlines from underneath the operating room table to go over the surgical site within 60 seconds.
A. Correct.
Q. Now you mentioned earlier with respect to the predictability of CFD is only for a certain period of time.

A. Yes.
Q. And you mentioned, for example, weather predictions are only good for seven days.
A. Yes.
Q. In this case, in this CFD, how long can you run the CFD before the result -- before the -- before it's no longer predictable?
A. I don't know the answer to that, and I don't think anyone does.
Q. Okay.
A. In fact no one knows the answer to that.
Q. Okay. So you're not saying that if you ran it for a hundred seconds of simulation time that the results would be incorrect, or non-predictable.
A. You used two negatives in that. Could you rephrase that question?
Q. You're right, it was a bad question.
Your 2540 TRN file was a simulation time of 5.2 seconds; correct?
A. I don't believe that's correct.
Q. How much --
What simulation time do you think it is?
A. I think it was 5.07.
Q. You are right, it was 5.07. Correct.
A. Were you trying to trick me?

Q. No.
(Laughter.)
Q. And you believe within -- at 5.07 seconds that the CFD simulation is predictive of what would happen.
A. The TRN file which I provided, which is associated with 5.0 seconds of calculation time as we've talked about, I believe is predictive, is able to predict the pattern of flow through 60 seconds.
Q. Okay. What about if you ran the CFD for 10 seconds of simulation time, would it also -- would it also predict the pattern of flow of 60 seconds of streamline time?
A. I would expect it would.
Q. What about 50 seconds?
A. I expect it would.
Q. What about 75 seconds?
A. I expect it would.
Q. Well what would be the upper limit then?
A. Of simulation time?
Q. Yeah. To pre --
A. You could run it forever.
Q. But you said after you run it for such a long time it's no longer predictive.
A. Oh --

Q. Or did I misunderstand you?
A. Yeah, you misunderstand. You're confusing two different times. You're confusing simulation time with time on the streamline.
Q. Okay. Okay. So when you're talking about whether or not it can predict airflow, you're talking about the streamlines.
A. That is correct.
Q. Not about simulation time.
A. Well I'm using both. We're using both times in our -- in our conversation here, so we need to be clear about which time we're actually talking about.
Q. Yes.
And I'm talking about simulation time, how -- how long you run the CFD.
You're not saying that the longer you run it there's a certain limit where it's no longer predictive.
A. I am not saying that.
Q. Okay. Computational fluid dynamics is a method that can be used to predict airflow in an operating room; correct?
A. Yes.
Q. And actually you were originally retained by 3M back in 2015 to predict the airflow in an operating

10:18:45 room with the Bair Hugger in it; correct?
10:18:47 **A.** Yes.
10:19:30 **Q.** When you were looking at the streamlines to
10:19:31 determine quasi-steady state, did you see any changes
10:19:39 in the streamlines between TRN files?
10:19:41 **A.** Yes.
10:19:44 **Q.** Did you calculate or determine the delta or
10:19:48 the change in streamlines between the different TRN
10:19:51 files?
10:19:52 **A.** That's a poorly-posed question because
10:19:55 you're asking me "change," you haven't told me the
10:19:59 change in what.
10:20:00 Are you talking about position, velocity,
10:20:01 time, et cetera?
10:20:02 **Q.** Any change. Change in velocity,
10:20:05 temperature, vectors.
10:20:09 **A.** There were slight changes over time. And in
10:20:14 fact that's always the case with a simulation like
10:20:17 this. That was the case with Elghobashi's simulation
10:20:20 as well.
10:20:21 **Q.** I understand that you want to compare your
10:20:23 simulation to Dr. Elghobashi's simulation, but I'm
10:20:26 just...
10:20:29 I want you to answer my questions of how you
10:20:31 support your opinions and your analysis based on

10:20:39 generally accepted engineering methodology and what
10:20:41 you did.
10:20:42 **A.** I understand that.
10:20:46 **Q.** When you say "slight change," a slight
10:20:48 change in what with respect to the streamlines?
10:20:50 **A.** What I looked at is change of the position
10:20:52 of the streamlines from one calculation to the next.
10:20:59 **Q.** And when you say "position," you're talking
10:21:01 about the actual coordinates.
10:21:03 **A.** Yes.
10:21:13 **Q.** And did you look at the change in
10:21:15 temperature?
10:21:18 **A.** I did not use the change in temperature to
10:21:22 mark quasi-steady, I used the flow patterns
10:21:26 themselves.
10:21:26 **Q.** Was there a change in temperature between
10:21:28 the TRN files in the operating room?
10:21:31 **A.** There certainly would be a change in
10:21:33 temperature. I don't -- I didn't quantify it because
10:21:37 it wasn't important. I looked at the change in
10:21:41 trajectory of the flow.
10:21:47 **Q.** Was there a change in turbulence intensity
10:21:50 between the different TRN files?
10:21:52 **A.** There certainly would be a change in
10:21:54 turbulence intensity and turbulence level, but again I

10:21:57 used the trajectory of the flow.
10:22:04 **Q.** Was there an increase in turbulence over
10:22:07 time?
10:22:07 **A.** I don't know if there was an increase or
10:22:09 decrease in turbulence intensity over time.
10:22:12 **Q.** Was there an increase in temperature over
10:22:14 time in the operating room?
10:22:15 **A.** I don't know if there was an increase in
10:22:16 temperature or a decrease in temperature over time in
10:22:21 the operating room.
10:22:27 **Q.** But that's something that anyone in the
10:22:30 field that has access to ANSYS could determine based
10:22:34 off of your TRN files; correct?
10:22:36 **A.** Yes.
10:23:21 **Q.** On the 505 model, at time zero -- Strike
10:23:27 that.
10:23:28 Did you run the 505 CFD model with the Bair
10:23:34 Hugger off?
10:23:35 **A.** No.
10:23:38 **Q.** So sitting here today you do not know what
10:23:41 the streamlines would look like with the Bair Hugger
10:23:44 off of air coming from underneath the table.
10:23:49 **A.** That is correct.
10:23:52 **Q.** And since the Bair Hugger's off, there would
10:23:54 be no exhaust to the streamlines from the Bair Hugger

10:23:56 itself.
10:23:57 **A.** That would be correct.
10:23:58 **Q.** Okay. At time zero, when you turned the
10:24:10 Bair Hugger on, did you have anything in your initial
10:24:26 conditions that would have estimated the flow pattern
10:24:33 of the exhaust from the Bair Hugger blanket?
10:24:37 **A.** Yes.
10:24:38 **Q.** What was that?
10:24:39 **A.** I would have either used a initial condition
10:24:43 which was a steady-state calculation, or I may have
10:24:46 used an initial condition from the 750. I don't
10:24:50 recall which initial condition I used.
10:24:52 **Q.** Between the 505 calculation, CFD
10:24:56 calculation, and the 750, what changes were made?
10:25:00 **A.** The flow rate from the Bair Hugger.
10:25:03 **Q.** Anything else?
10:25:04 **A.** No other changes.
10:25:06 **Q.** Okay. Geometry was the same; correct?
10:25:08 **A.** Geometry was the same.
10:25:13 **Q.** The temperature coming at the diffusers, the
10:25:17 inlet temperature at the diffusers were the same;
10:25:19 correct?
10:25:20 **A.** Yes.
10:25:20 **Q.** You used 41 degrees Celsius as the exit
10:25:24 temperature of the Bair Hugger exhaust; correct?

10:25:26 **A.** Yes.
10:25:39 **Q.** Why was the cost to 3M more for the 505 CFD
10:25:47 than the 750 if the only thing that you had to change
10:25:52 was the -- the flow rate out of the Bair Hugger
10:25:56 blanket?
10:26:00 **A.** Well the fact is I think that I
10:26:03 significantly undercharged for the first study. It
10:26:07 took a lot of time. And the cost for the second study
10:26:11 was a more accurate representation of the work
10:26:14 required.
10:26:20 **Q.** Did anyone assist you in the 505?
10:26:24 **A.** No one assisted me in the 505.
10:26:28 **Q.** So Mr. Plourde --
10:26:31 Is it Plourde?
10:26:33 **A.** Plourde.
10:26:34 **Q.** -- Plourde or Ms. Vallez did not assist you?
10:26:38 **A.** That is correct.
10:26:48 **Q.** So it's your opinion that you undercharged
10:26:50 3M for the 750 model?
10:26:56 **A.** It's my opinion --
10:26:58 Yes, that is my opinion.
10:27:00 **Q.** Okay. And so you decided to overcharge them
10:27:02 for the 505?
10:27:03 MR. GOSS: Object to form.
10:27:04 **A.** I didn't say that.

10:27:06 **Q.** I'm asking you that.
10:27:07 **A.** I did not --
10:27:08 MR. GOSS: Object to form.
10:27:09 **A.** I did not overcharge them for the 505.
10:27:11 **Q.** Okay.
10:27:11 **A.** And I never said that I overcharged them.
10:27:14 **Q.** How long did it take to run the 505 model?
10:27:18 **A.** I don't recall the time it took.
10:28:05 (Abraham Exhibit 2 marked for
10:28:05 identification.)
10:28:05 BY MR. ASSAAD:
10:28:07 **Q.** This is an invoice from you to 3M
10:28:13 Corporation for $14,000 to do a numerical simulation
10:28:20 of airflow within an OR during use of a Bair Hugger
10:28:23 505 blower blanket; is that correct?
10:28:25 **A.** Yes.
10:28:26 **Q.** And it's dated April 7th, 2017; correct?
10:28:30 **A.** Correct.
10:28:31 **Q.** Did you submit this invoice before or after
10:28:34 you started the project?
10:28:39 **A.** Boy, I'm pretty sure it was after. I mean
10:28:43 my -- my typical practice is to submit an invoice
10:28:45 after.
10:28:46 **Q.** Okay. So you completed the modeling, the
10:28:51 numerical simulation for the 505 by April 7th, 2017.

10:28:54 **A.** That is what I recall.
10:28:56 **Q.** Okay. And do you know when you began the
10:29:06 project?
10:29:08 **A.** I don't recall.
10:29:09 **Q.** Do you know if it was in 2016?
10:29:11 **A.** I don't believe it was 2016.
10:29:13 **Q.** Okay. So your best guess would be somewhere
10:29:18 between January 1st, 2017 and April 7th, 2017.
10:29:26 **A.** Yes.
10:29:48 **Q.** Did the time it take to run the 505 model,
10:29:52 was that longer or shorter than the run on the 750?
10:29:59 **A.** I don't recall.
10:30:04 **Q.** Is there anything you changed in the model,
10:30:10 such as the equations or the assumptions, between the
10:30:12 505 and the 750?
10:30:16 **A.** I think the only thing I changed was the
10:30:19 flow rate out the Bair Hugger.
10:30:25 **Q.** And you still used the Boussinesq
10:30:30 approximation.
10:30:31 **A.** Yes.
10:30:32 **Q.** And the model for the 505 is a Large-Eddy
10:30:36 Simulation; correct?
10:30:37 **A.** Yes.
10:30:37 **Q.** And you ran it as a Large-Eddy Simulation
10:30:40 from time zero to 5.07 seconds?

10:30:42 **A.** Yes.
10:30:43 **Q.** At no time between the beginning of the run
10:30:47 and the 2540 TRN file was RANS ever used.
10:30:54 **A.** No.
10:30:57 MR. GOSS: I want to make sure we get that
10:30:58 one. I think there were two negatives. Well...
10:31:09 **A.** RANS was not used.
10:31:12 MR. GOSS: Thank you.
10:31:14 **Q.** Was RANS used at any time with respect to
10:31:17 your work on the 505?
10:31:19 **A.** It may have been used for the initial
10:31:21 conditions, although I don't recall.
10:32:03 **Q.** You ran the model further than 5.02 seconds
10:32:10 at a later time; correct?
10:32:12 MR. GOSS: Object to form.
10:32:15 **Q.** 07 seconds. My fault.
10:32:17 **A.** Yes.
10:32:17 **Q.** How far --
10:32:18 How long did you run the model for?
10:32:20 **A.** I don't recall.
10:32:20 **Q.** Did you produce all the files that you
10:32:24 created with respect to your 505 work?
10:32:30 **A.** Yes.
10:32:38 **Q.** Did you destroy any files or delete any
10:32:40 files?

10:32:40 **A.** No.
10:32:42 **Q.** So I take it that you produced a TRN file
10:32:46 for every 10 time steps; correct?
10:32:50 **A.** That is what I recall.
10:32:51 **Q.** Okay. So there's a TRN file for time step
10:32:56 10; correct?
10:32:59 **A.** Following the 2540.
10:33:02 **Q.** What about before the 2540?
10:33:04 **A.** As I recall, I produced two time steps
10:33:07 before the 2540.
10:33:10 **Q.** I understand what you produced, but you set
10:33:12 it up that when you ran the 505 that it would create a
10:33:20 TRN file for every time step; correct? Every ten time
10:33:23 steps.
10:33:23 **A.** That is correct.
10:33:24 **Q.** Okay. So when you ran the 505, it created
10:33:27 time steps for 10, 20, 30, 40, 50 and so on; correct?
10:33:32 **A.** Yes.
10:33:32 **Q.** Okay. And where are those files now?
10:33:35 **A.** Those files are no longer -- I no longer
10:33:38 have them. What I produced, the TRN file is the
10:33:41 master file, and from that you can recreate the
10:33:44 results. It's our practice in simu --
10:33:47 These files are large, and I think
10:33:50 Elghobashi testified to this. Sometimes they're so

10:33:52 large you can't send them. So it's our practice to
10:33:56 keep the essential files, the master file, and that's
10:33:59 what I did.
10:34:00 **Q.** And which is the master file?
10:34:01 **A.** 2540.
10:34:02 **Q.** Why is that the master file?
10:34:04 **A.** Because it is a file that shows the
10:34:06 quasi-steady results.
10:34:08 **Q.** Are you saying that 2530 does not show
10:34:12 quasi-steady results?
10:34:13 **A.** No. I'm not saying that.
10:34:15 **Q.** Okay. Did all the TRN files show
10:34:20 quasi-steady results?
10:34:22 **A.** I ran the results long enough until
10:34:24 quasi-steady state was achieved, and then I used a
10:34:28 representative file from that set, and I call that the
10:34:31 master file, and that's what was produced.
10:34:33 **Q.** Okay. And the other files you deleted
10:34:35 because they were large.
10:34:36 **A.** No, --
10:34:37 MR. GOSS: Object to form.
10:34:38 **A.** -- I didn't.
10:34:39 They are large, that's a fact. They are
10:34:43 difficult to send. In fact I think that the
10:34:47 plaintiffs' experts has not sent any files because he

10:34:50 said they were too large. I produced a representative
10:34:53 file so that anyone could reproduce my work. A master
10:34:56 file so anyone could reproduce my work.
10:34:58 Now that master file has all the information
10:35:01 that's needed. It has the geometry, it has the mesh,
10:35:05 it has the boundary conditions, and it has the
10:35:07 results. So I produced a master file which can be
10:35:11 used to reproduce my work.
10:35:13 **Q.** And when you say someone could run it, they
10:35:15 can run it forward?
10:35:16 **A.** Yes.
10:35:16 **Q.** For how long?
10:35:17 **A.** As long as they want.
10:35:20 **Q.** So they could run it forward for an hour of
10:35:22 simulation time?
10:35:23 **A.** Yes.
10:35:24 MR. GOSS: Object to form.
10:35:25 **Q.** And would that be accurate, would it --
10:35:27 would it be predictive of what would happen after 60
10:35:30 minutes of simulation time?
10:35:31 **A.** It may be.
10:35:43 **Q.** So what did you do with the other files
10:35:47 pri -- like -- that are before the 2540 file?
10:35:52 **A.** Two were maintained, and I believe those
10:35:54 were provided. And the other files I did not

10:35:57 maintain.
10:35:59 **Q.** Which means you deleted them.
10:36:02 MR. GOSS: Object to form.
10:36:03 **A.** They were deleted, but you're using the word
10:36:08 "delete" to imply that I'm withholding evidence.
10:36:11 **Q.** I am not, sir.
10:36:12 **A.** Well I --
10:36:14 **Q.** I'm just asking were they physically
10:36:16 deleted?
10:36:17 **A.** What was retained, and what is the practice
10:36:19 in our field is to retain the master file. I retained
10:36:23 that master file, in fact I retained extra files that
10:36:28 aren't even needed, and those were provided.
10:36:30 It is not practice to retain every single
10:36:33 file because they are very large and it's almost
10:36:37 impossible to send them.
10:36:46 **Q.** The files were on a computer; correct?
10:36:49 **A.** Yes.
10:36:49 **Q.** On your 16 core computer that you used for
10:36:51 the simulation; correct?
10:36:52 **A.** Yes.
10:36:53 **Q.** And you did not retain those files; correct?
10:36:58 **A.** Again, I retained any essential file that
10:37:02 was needed to assess my work. I didn't retain every
10:37:05 single file, but I retained the file that has the

mesh, the geometry, the boundary conditions, and the results. That's all that's needed. I retained that file, and in addition I retained other files, which are an overabundance of files.

Q. And I'll ask you this again. And you deleted the other files.

A. I deleted any unimportant or unessential files.

Q. Okay. And when you say nonessential or unimportant, that's nonessential and unimportant to you.

A. No. It's not essential and unimportant to answering the question that I wanted to answer. And that question is: Does air from the Bair Hugger get near the surgical site within 43 seconds. I retained every file that is needed to answer that question.

Q. The initial file would contain the initial conditions; correct?

A. I don't know what you mean by "initial file."

Q. Well you created --

You had initial conditions; correct?

A. Correct.

Q. And you mentioned earlier that you didn't know how they were created, whether or not you created

it with a RANS model or you did calculations; correct?

A. What I said earlier in this deposition was I either used a RANS or I used my result from the prior Bair Hugger.

Q. Okay.

A. Now it turns out the initial conditions are not that important. You can get the same result if you use different initial conditions.

Q. Well if I put the initial conditions and set the temperature of the room at -- for the air space in the room at 90 degrees Celsius, it would take awhile for the room to come to quasi-steady state with respect to temperature; correct?

MR. GOSS: I wouldn't want to be in that room.

MR. ASSAAD: I understand that.

A. It may.

Q. Okay. So the initial conditions are important with respect to the change between 5.07 seconds and what was the initial condition; correct?

A. No. You see, what is important is that you reach quasi-steady state, and whatever your initial conditions are don't matter.

Q. So it's your engineering opinion that as long as you reach quasi-steady state, initial

conditions for a computation fluid dynamics model is irrelevant. Is that what I'm understanding?

A. I'm going to answer it. If your initial conditions are very far off the mark, your calculation will do something called diverge. That means it will not converge to any result that's meaningful.

Provided your initial conditions are sufficiently accurate, your results will converge to a quasi-steady result and that convergence will be imma -- will be independent of the actual initial conditions.

Q. So my understanding is if your initial conditions are way off, for lack of a better term, it might cause the analysis to diverge and you won't get a solution.

A. That is correct.

Q. Okay. Or it might cause an error in the solution and it won't be able to solve; correct?

A. That is correct.

Q. If you ran the CFD forward -- your CFD forward, whether it's the 750 or the 505, do you expect it to -- to continue to converge on data and solve the problem?

A. I would expect that that would be the case.

Q. Okay. Because in some reading I've done, or

research, sometimes the CFD will be unable to solve a problem because it either crashes or it diverges; correct?

A. Right. And we've talked about that here.

Q. Just now.

A. We've talked about it diverging in solution.

Q. Okay.

A. I mentioned that explicitly.

Q. And when a -- and a solution diverges, what does that tell you?

A. It can tell you --

It could diverge for a number of different reasons. It could diverge because you have something unphysical happening.

Q. Okay. What else?

A. It could diverge because one of your elements is a negative volume element.

Q. Any other reason?

A. Those are the two reasons that are coming to my mind now.

Q. Okay. And if something diverges, say, after ten seconds of simulation time, what does that tell you about the data before that ten seconds?

A. It --

I would have to look at the specifics. It

may not tell anything, but it may tell something. But I'd have to look at the specifics of why it diverged.

Q. Okay. But it would be very concerning to you if you ran a CFD and it diverged.

MR. GOSS: Object to form.

A. It depends on why it diverged. I don't -- I wouldn't say a priori it would be very concerning. I mean, I'd want to know why, but it may or may not concern me.

Q. And to determine whether or not there is divergence -- why the divergence occurred, you would need the initial conditions; correct?

A. No.

Q. "No"?

A. No.

Q. What would you need?

A. So, for example, I gave two reasons why a solution might be -- might diverge, and one was unphysical boundary conditions or unphysical conditions.

Q. What do you mean by "unphysical," by the way?

A. Let's say --

Let's think about this room. Let's say that we have ventilation flow coming in from the ceiling

and we set up a CFD model and we have no outflow. We have no way for that air to leave. Over time, air is going to be entering the room, it's going to be filling up the room, the room is going to become pressurized and it will continue on to infinity. That would be an unphysical situation. We know that's not true.

Q. Okay.

A. So there has to be some outlet to this room. The outlet may be another vent, it may be underneath the door, but that would allow the solution not to diverge.

Another example, using this room again, would be related to heat. We have things that are generating heat. You are, I am, every -- every electronic device is, and that heat has to go somewhere. If in our simulation we don't provide an -- an avenue for the heat to leave, the heat would build up to infinity and that would be another divergence. So it depends on the cause.

Q. And would those divergence cause the CFD model to crash?

A. The two that I mentioned would.

Q. Okay. Any other divergence that could cause a CFD model to crash?

A. I think if you took too large of a time step, that may cause divergence -- that would cause divergence.

Q. What about too small of a time step?

A. Oh boy. I've never heard of too small of a time step causing divergence. I suppose if your time step was so small that the results were within the truncation error of the chip, that would -- that would be an issue for me, that would be a question. I don't know if that would cause divergence. I -- I would say this. I've never heard of too small of a time step causing divergence.

Q. Now the example I gave you before with the initial conditions of a room being at like 90 degrees Celsius, if divergence occurred because of that scenario that was because I picked poor initial conditions; correct?

A. If the init -- If the convergence --

If the divergence occurred because you set a room at 90 degrees Celsius, then yes, your initial conditions would have caused the divergence.

Q. So bad initial conditions could cause divergence.

A. Yes. And I've already stated that.

Q. Now you've had your deposition taken before

in this -- in the multidistrict litigation; correct?

A. Yes.

Q. And you reviewed it and signed it for corrections; correct?

A. Yes.

Q. And you made three changes; correct?

A. I don't recall the changes.

Q. Okay. You made some minor changes to the -- on your errata sheet.

Do you know what an errata sheet is?

A. Yes, I do.

Q. Okay. Did you review your deposition in preparation of today's deposition?

A. Yes.

Q. And when was the last time you read your deposition?

A. Within the last week.

Q. Did you meet with anyone with respect to your -- in preparation of today's deposition?

A. Yes.

Q. With counsel?

A. Yes.

Q. And when did you meet?

A. I believe Monday and Tuesday of this week.

Q. And how long did you meet for?

10:47:54 A. Approximately two hours each time.
10:47:56 Q. Okay. Was anyone there besides counsel?
10:48:01 A. No.
10:48:03 Q. Prior to this week did you meet with them in
10:48:07 preparation of today's deposition?
10:48:11 A. I don't recall meeting with them prior to
10:48:16 this week in preparation for this deposition.
10:48:18 Q. Okay. Have you met with them since your
10:48:29 last depo?
10:48:30 A. Yes.
10:48:31 Q. How many times?
10:48:33 A. Oh, I don't know. I've met with them twice
10:48:35 this week, as I've mentioned.
10:48:37 Q. Besides this week.
10:48:39 A. I don't know how many times. Not very many,
10:48:43 because I've been out of the country for a lot of that
10:48:46 time period.
10:48:47 Q. For work?
10:48:48 A. For work and family travel.
10:48:51 Q. Okay. Would the times that you meet with
10:49:00 counsel in this case be on your invoices?
10:49:06 A. You know, I don't know. I tend to not
10:49:09 charge for a lot of things. I tend not to charge for
10:49:12 phone calls. I don't charge for travel, and short
10:49:17 meetings I tend not to charge. So it is possible a

10:49:21 meeting occurred that is not on the invoice.
10:49:25 Q. Have you met with anyone else besides
10:49:27 counsel regarding your CFD analysis in this case?
10:49:31 A. No.
10:49:36 Q. What is a short meeting?
10:49:40 A. Less than an hour maybe.
10:49:42 Q. Okay. Have you --
10:49:46 Have you had any discussions with regard to
10:49:49 your CFD analysis with any other professors?
10:49:59 A. No.
10:50:21 MR. ASSAAD: Let's take a break.
10:50:23 THE REPORTER: Off the record, please.
10:50:24 (Recess taken from 10:50 to 11:01 a.m.)
11:01:07 BY MR. ASSAAD:
11:01:16 Q. I want to back up a little bit just so I
11:01:19 understand what your opinions are with respect to the
11:01:21 streamlines and your quasi-steady determination.
11:01:27 You agree with me that between the different
11:01:33 TRN files that you've run there is a change in
11:01:38 temperature.
11:01:39 A. I did not agree to that. I said there may
11:01:41 be.
11:01:42 Q. So you don't know one way or the other.
11:01:45 A. There would be some cha --
11:01:47 There has to be some change in temperature,

11:01:49 but any change in temperature would be immaterial to
11:01:52 the conclusions of my report.
11:01:54 Q. Okay. But there would be some change in
11:01:56 temperature based on your education, training and
11:01:58 experience.
11:01:58 A. There have to be.
11:01:59 Q. Because you have a heat source in the room.
11:02:04 A. That's not the reason. It's because flow --
11:02:09 airflow in any space is going to have some change in
11:02:12 temperature.
11:02:14 Q. But all --
11:02:14 A. It may be small, it may be large, but there
11:02:17 would be -- have to be some non-zero change in
11:02:19 temperature.
11:02:20 Q. Okay. But also you have a Bair Hugger
11:02:21 device that's blowing warm air into the operating
11:02:24 room.
11:02:25 A. That is true, and there's also a ventilation
11:02:28 system that's blowing cold air.
11:02:30 Q. Okay. With respect to velocity, is there
11:02:35 going to be a change in the velocity at certain points
11:02:40 in the operating room between different TRN files?
11:02:43 A. There has to be some non-zero change in
11:02:46 velocity at certain points.
11:02:48 Q. Okay. And that would include the velocity

11:02:52 vectors; correct?
11:02:54 A. That would include the velocity vectors.
11:02:56 Q. Okay. And there would be a change in
11:03:04 turbulent intensity between the different TRN files;
11:03:07 correct?
11:03:08 A. With any unsteady flow there would have to
11:03:10 be a non-zero change in turbulence intensity.
11:03:15 Q. And you consider this an unsteady flow;
11:03:17 correct?
11:03:17 A. This is an unsteady flow.
11:03:19 Q. And that's why it's -- you're using LES.
11:03:23 A. No.
11:03:24 Q. That was a bad question. You are correct.
11:03:25 Because you can use RANS for an unsteady
11:03:28 flow; correct?
11:03:29 A. Correct.
11:03:39 Q. But when you run LES it is a transient flow;
11:03:41 correct?
11:03:42 A. That is correct.
11:03:43 Q. And "transient" means that it's changing
11:03:45 over time; correct?
11:03:46 A. That is correct.
11:03:59 Q. Now when you ran the streamlines on the 2540
11:04:04 TRN file you are looking at the results with respect
11:04:19 to velocity and its vectors just for that specific

11:04:25 time; correct?
11:04:27 **A.** That is correct.
11:04:28 **Q.** Okay. So for example, the 2540 TRN file you
11:04:44 are basically freezing the model and looking at the
11:04:46 velocity vectors to determine the airflow; correct?
11:04:53 MR. GOSS: Object to form. Go ahead.
11:04:54 **A.** That's correct. And let me explain how this
11:04:57 works.
11:04:58 **Q.** Well let me just ask a couple questions just
11:05:00 so --
11:05:01 **A.** No, I would like to explain.
11:05:02 **Q.** Okay. But the answer to my question is
11:05:04 "yes."
11:05:04 **A.** That is --
11:05:05 Yes.
11:05:06 **Q.** Okay.
11:05:07 **A.** So when you're dealing with an unsteady
11:05:09 problem you have results at every time step. Think of
11:05:14 it like a movie, and then you have the individual
11:05:19 frames. If you want to know, let's say, what is
11:05:25 happening to the flow or particles during that movie,
11:05:30 you have two options: One, you can take a bunch of
11:05:38 frames and smear them out. So think about a -- if
11:05:41 you're looking at a fire, you're taking a bunch of
11:05:44 snapshots of a fire. And a fire changes over time, I

11:05:48 think we would agree. And in one method you take
11:05:54 maybe a hundred or a thousand snapshots and you
11:05:58 average them together, so instead of a fire you get a
11:06:00 blob. Okay. That's called a time-averaging
11:06:05 technique. That I believe is the incorrect way of
11:06:08 doing it, although that's the way Elghobashi did his
11:06:10 work.
11:06:11 I think you don't average. I think what you
11:06:13 do is you take individual snapshots and you say what
11:06:18 is the flow pattern in this frame, then what is the
11:06:20 flow pattern in the next frame, and what is the flow
11:06:23 pattern in the third frame. I think that's a much
11:06:26 more rigorous way and accurate way of looking at the
11:06:29 results. That's what I did.
11:06:31 And as to your question, the TRN file is a
11:06:33 frame. Think of it as a frame in a movie.
11:06:38 **Q.** It's an individual frame; correct?
11:06:40 **A.** That's what I said.
11:06:41 **Q.** Okay. And there's no change in that frame
11:06:43 with respect to temperature.
11:06:45 **A.** I did not say that.
11:06:47 **Q.** Well if you look at the TRN file, you're
11:06:50 looking at a still frame at that point in time.
11:06:53 **A.** Yes.
11:06:54 **Q.** Okay. And you're running the streamline for

11:07:08 60 seconds in that individual frame.
11:07:12 **A.** That is correct. I'm tracking the path of
11:07:18 the flow over a 60-second time period in that frame.
11:07:23 **Q.** Okay. So my -- the answer to my question is
11:07:25 "yes."
11:07:27 **A.** I think I answered it.
11:07:32 **Q.** You're running the streamline for 60 seconds
11:07:34 in that individual frame.
11:07:35 **A.** That is correct.
11:07:36 **Q.** Okay. And in that frame you agree with me
11:07:57 that what is happening at 5.02 seconds --
11:08:11 MR. GOSS: Seven seconds? 5.07?
11:08:14 MR. ASSAAD: 5.07 seconds. I don't know
11:08:16 why I keep saying "2."
11:08:18 **Q.** -- 5.07 seconds, the velocity vectors are
11:08:20 going to be different at 6.07 seconds.
11:08:27 **A.** In an unsteady flow they have to be
11:08:29 different.
11:08:30 **Q.** And we are in an unsteady flow here;
11:08:33 correct?
11:08:34 **A.** That is correct.
11:08:34 **Q.** Okay. So the forces on a particle, the
11:08:37 velocity forces are going to have different vectors
11:08:44 that are on that particle at 6.07 seconds than were on
11:08:49 5.07 seconds; correct?

11:08:51 **A.** That was a very cumbersome question. Could
11:08:54 you --
11:08:54 You said the forces on a particle, period.
11:08:58 Could you restate the question?
11:08:59 **Q.** I will.
11:09:00 Streamlines are based on velocity vectors.
11:09:06 **A.** Correct.
11:09:07 **Q.** And it's the tangent to the velocity vector.
11:09:10 **A.** That is correct.
11:09:11 **Q.** Okay. The velocity vector at 5.02 seconds
11:09:16 -- 7 seconds -- is going to be different than the
11:09:18 velocity vector at 6.07 seconds; correct?
11:09:22 **A.** It has to be.
11:09:23 **Q.** Because it's unsteady flow.
11:09:24 **A.** Correct.
11:09:25 **Q.** Okay. So when you run your streamline,
11:09:27 okay, your streamline at one second, the velocity
11:09:33 vectors at that time are going to be different than
11:09:42 when you first started the streamline at five oh seven
11:09:45 seconds.
11:09:46 **A.** Well one second would be before 5.07, but I
11:09:50 would say this. The streamlines change in time.
11:09:52 **Q.** Okay.
11:09:53 **A.** In an unsteady flow the flow patterns --
11:09:57 everything is always changing, and that's why I want

to go back to the how do you handle it.
It's a movie, okay?
Q. I --
A. A fire is changing in time and you have to decide to describe -- you have to --
If you want to describe the fire you have to make a choice of how you describe it. Your choices are to average all of it out and not account for the changes in time. That's one choice. It's the incorrect choice, but that's the choice Elghobashi made. Your other choice is to look at each individual frame, which I think is the more rigorous choice and that's the choice I made. So your streamlines necessarily change in time, because it's an unsteady flow.
Q. And because they change in time, a streamline that you show at 5.07 seconds is not going to tell you where the particle is at 6.07 seconds; correct?
A. I think you're confusing times here.
But yes, I would say this: Any TRN file which is at a different -- it's a different snapshot in a movie, will show a difference from any other snapshot. I agree to that.
So the question is, are those snapshots

representative of what's actually happening.
Q. And to follow a particle and to account for the chan -- for the unsteady state because of the changing in velocity vectors you would have to run, like a movie, a particle at 5.07 seconds, and then look at that particle where it is at 6.07 seconds, 7.07 seconds, because unless you follow the particle in each frame you're not going to get the true effect of the velocity vectors on a particle. Isn't that correct?
A. I disagree.
Q. Okay. So if you look at your streamlines at 20 seconds, are you telling me that the velocity vector at 20 seconds is going to be the same velocity vector acting on that point if you did a simulation that was at 25.07 seconds?
A. I would say this. I ran thousands of calculations, and for those calculations I tracked the flow for 60 seconds and I observed no meaningful change in the flow patterns, and I observed none of those streamlines approaching the -- getting into the surgical site. Now whether we call that above the operating table, whether we call that the knee or the hip or the operating theater, I don't care what you call it. But I calculated streamlines, snapshots --

many thousands of snapshots and I never observed that.
Now it turns out I was overly ambitious. I calculated the streamlines for 60 seconds, and now I understand that, according to Elghobashi, the particles would reach there in 43 seconds. So if I could do it again knowing what I know now, I would have only tracked the streamlines for 43 seconds. But the resul -- the conclusion would be the same, in fact it would be a stronger conclusion.
Q. Okay. So what's the answer to my question?
A. I don't recall what your question is.
Q. Because I don't recall what you're answering, because it wasn't the answer to my question, so let's go back.
My question is: If you look at your streamlines at 20 seconds, is it your opinion that the velocity vector at 20 seconds is going to be the same velocity vector acting on that point if you did a simulation that was at 25.07 seconds?
A. And the answer is no.
Q. Okay. Now you mentioned that you may have used the 750 CFD analysis for your initial conditions?
A. I may have.
Q. How would you know?
A. I don't know. Sitting here now, I don't

know.
Q. So --
A. And of course it doesn't matter.
Q. I understand that, according to you. But --
A. No. No, that's not true.
Q. Okay.
A. According to how CFD works it doesn't matter. As I've said today, and as I've said in our last deposition, the actual initial conditions don't matter. You don't need the same initial conditions to get to the same result, so it doesn't matter.
Q. Did you read plaintiffs' motion to exclude you in the general cause part?
A. Yes.
Q. And did you read the transcript of the Court with respect --
A. Yes, I did.
Q. So just to sum it up. It's my understanding that your -- that it's your opinion that initial conditions don't matter.
A. No.
Here's my opinion, and I want to be very clear. Initial conditions -- You need initial conditions to get a solution, but provided your initial conditions are good enough, you should come to

11:15:49 the same ultimate result and the same conclusion.
11:15:54 As I said earlier in this deposition, your
11:15:55 initial conditions could be so crazy that it could
11:15:58 cause divergence. So your initial conditions may
11:16:02 matter in that circumstance, but if your initial
11:16:05 conditions are good enough, you will come to the
11:16:07 correct ultimate solution.
11:16:09 **Q.** Okay. And the transient model is dependent
11:16:21 on the initial conditions; correct?
11:16:27 **A.** Well I think I just answered that, but let
11:16:29 me answer it again in a way that maybe makes more
11:16:32 sense.
11:16:33 **Q.** Well can you answer that question "yes" or
11:16:35 "no"?
11:16:37 **A.** It's not a question that can be answered
11:16:39 "yes" or "no."
11:16:40 **Q.** Okay.
11:16:40 **A.** The answer is -- You asked does a transient
11:16:44 model depend on the initial conditions. And I just
11:16:47 gave an example of where the model does depend on the
11:16:51 initial conditions. You could give a crazy initial
11:16:53 condition. If I assumed the air in this room was a
11:16:56 thousand degrees and then I started my calculation, it
11:16:59 may diverge. But if I gave reasonable initial
11:17:03 conditions, it wouldn't diverge. So provided your

11:17:07 initial conditions are good enough, they do not affect
11:17:09 the ultimate conclusion of the calculations.
11:17:13 **Q.** You agree with me that the first time step
11:17:16 depends on the initial condition.
11:17:17 **A.** I agree the first time step depends on the
11:17:20 initial condition.
11:17:37 **Q.** And you agree with me that the time it takes
11:17:44 for you to determine quasi-steady state depends on the
11:17:49 initial conditions.
11:17:50 **A.** It may.
11:18:27 (Abraham Exhibit 3 marked for
11:18:27 identification.)
11:18:27 BY MR. ASSAAD:
11:18:49 **Q.** Do you recognize what's been marked as
11:18:51 Exhibit 3?
11:18:54 **A.** Yes, I do.
11:18:58 **Q.** What is Exhibit 3?
11:19:00 **A.** Exhibit 3 is a journal publication which I
11:19:02 authored.
11:19:04 **Q.** Did you author it with anybody else?
11:19:05 **A.** Yes.
11:19:06 **Q.** Who?
11:19:07 **A.** Brian Plourde and Lauren Vallez.
11:19:11 **Q.** You agree with me that there's information
11:19:13 in Exhibit 3 that was not in your expert report that

11:19:17 was submitted in the general causation case.
11:19:19 **A.** I agree.
11:19:20 **Q.** Okay. Does the --
11:19:26 Does Exhibit 3 contain any results of the
11:19:34 505 modeling?
11:19:37 **A.** No.
11:19:46 **Q.** Do you recall that in your deposition you
11:19:48 indicated to me that -- that the article contained
11:19:52 results for the 505 modeling?
11:19:53 **A.** If I did, then that was an error.
11:20:24 (Abraham Exhibit 4 marked for
11:20:24 identification.)
11:20:25 BY MR. ASSAAD:
11:20:25 **Q.** I'd like you to look to page 79 of your --
11:20:27 Strike that.
11:20:28 Exhibit 4 is a copy of your deposition taken
11:20:32 on July 20th, 2017. Do you recognize this deposition?
11:20:40 **A.** Yes.
11:20:43 **Q.** And the -- the deposition was taken under
11:20:48 oath; correct?
11:20:49 **A.** Yes.
11:20:50 **Q.** And the court reporter was the astonishing
11:20:55 Stirewalt & Associates.
11:20:56 Do you recall that?
11:20:56 **A.** Yes.

11:20:58 MR. GOSS: Inestimable.
11:21:01 **Q.** Let's look at page 79.
11:21:08 And you had a chance to go back and read and
11:21:10 review your deposition for corrections.
11:21:12 **A.** That is correct.
11:21:13 **Q.** Okay. And you actually did that; correct?
11:21:15 **A.** That is correct.
11:21:16 **Q.** Okay. And you read it carefully; correct?
11:21:18 **A.** Yes.
11:21:19 **Q.** And you wanted to be as accurate as
11:21:22 possible.
11:21:22 **A.** That is right.
11:21:24 **Q.** And you read it again this week; correct?
11:21:26 **A.** That is correct.
11:21:27 **Q.** If you look at page 79, line 4, I asked you:
11:21:31 "Okay. And I know you -- in your
11:21:33 journal article you looked at 505
11:21:35 as well?"
11:21:35 And your answer was "yes."
11:21:37 **A.** That is correct.
11:21:38 **Q.** Are you saying that is incorrect?
11:21:40 **A.** Yes, I am.
11:21:40 **Q.** And you did not correct that in your errata
11:21:43 sheet; correct?
11:21:44 **A.** That is correct.

11:21:44 **Q.** And you did not --
11:21:45 **A.** I did not notice that error in my errata sheet.
11:21:48
11:21:58 **Q.** Now in the 750 report you only looked at 264 time steps; correct?
11:22:04
11:22:05 **A.** Incorrect.
11:22:10 **Q.** The results you looked at and the streamlines you created was on the 264 TRN file.
11:22:13
11:22:16 **A.** That is correct.
11:22:19 **Q.** And the temperature of the Bair Hugger was 41 degrees Celsius; correct?
11:22:20
11:22:22 **A.** Yes.
11:22:23 **Q.** The exhaust of the Bair Hugger.
11:22:24 **A.** Correct.
11:22:25 **Q.** Okay. And you looked at the Bair Hugger as only being on, correct, in the 750 report?
11:22:29
11:22:32 **A.** Yes.
11:22:33 **Q.** And there you used a nine-million-grid mesh.
11:22:37 **A.** I don't recall the size of the mesh.
11:22:39 **Q.** And the time step that was used was .01 seconds.
11:22:42
11:22:42 **A.** I don't recall the time step.
11:22:44 **Q.** Look at page 169 of your deposition of Exhibit 4.
11:22:48
11:22:59 **A.** (Witness complying.)

11:23:05 **Q.** Page -- Line 24.
11:23:10 "So if I represent to you that the
11:23:12 TRN files says .01 seconds, would
11:23:15 you disagree with that?
11:23:16 ANSWER: I would not disagree with
11:23:18 that."
11:23:18 So sitting here today, do you disagree that
11:23:21 the time step was .01 seconds?
11:23:23 **A.** No.
11:23:25 **Q.** And if I recall correctly, the 264.TRN was a
11:23:30 simulation time of 1.2 seconds. That sound about
11:23:33 right?
11:23:34 **A.** The T -- the 264 TRN corresponded to a 1.2
11:23:40 second --
11:23:40 **Q.** Okay.
11:23:40 **A.** -- simulation time.
11:23:45 **Q.** And is that as far forward as you ran the
11:23:49 TRN file, 264?
11:23:52 **A.** No.
11:23:52 MR. GOSS: The simulation?
11:23:54 **Q.** The simulation?
11:23:55 **A.** No.
11:23:56 **Q.** How far did you run it forward?
11:23:57 **A.** I think I stated in my deposition that I had
11:23:59 a file at 300, and one earlier, maybe 263. I don't

11:24:06 recall how far forward I ran it.
11:24:08 **Q.** In your report --
11:24:12 In your publication you mentioned that --
11:24:38 You said, "approximately two thousand time-step
11:24:41 calculations were completed."
11:24:42 **A.** Can you direct me to where that's stated?
11:24:45 **Q.** Yes, page 8.
11:24:48 MR. GOSS: Are we talking about his 750
11:24:51 report or his --
11:24:51 MR. ASSAAD: Publication.
11:24:52 MR. GOSS: -- Gareis report?
11:24:54 Oh, on the publication.
11:24:55 **Q.** Publication. I'm sorry.
11:25:08 **A.** Yes, I see that.
11:25:24 **Q.** So in Exhibit Number 3, which is your
11:25:28 report, on page 8 --
11:25:31 MR. GOSS: Article.
11:25:31 MR. ASSAAD: Huh?
11:25:32 MR. GOSS: The article; right?
11:25:34 MR. ASSAAD: Article.
11:25:35 MR. GOSS: Okay. Thanks.
11:25:35 MR. ASSAAD: Exhibit 3.
11:25:36 MR. GOSS: Thank you.
11:25:37 **Q.** You mention that you ran 2,000 time-step
11:25:44 calculations on the 750 model; correct?

11:25:47 **A.** Incorrect.
11:25:49 **Q.** "Approximately 2,000 time-step
11:25:51 calculations."
11:25:51 **A.** Incorrect.
11:25:59 **Q.** How many time step calculations were
11:26:00 performed on the 750?
11:26:04 **A.** Well what you're referring to here doesn't
11:26:07 relate to the 750. If you read the --
11:26:10 Let me read the paragraph. "One final
11:26:12 numerical calculation was performed with the cessation
11:26:17 of heated airflow from the" convective -- "convection
11:26:21 device. The spent air of the convection device was
11:26:25 converted to an adiabatic" -- A-D-I-A-B-A-T-I-C --
11:26:32 "no-slip wall in the simulation. The results were
11:26:36 obtained using the LES method previously described.
11:26:40 While approximately 2,000 time-steps" were --
11:26:46 "calculations were completed, virtually no difference
11:26:48 was found in the streamline pattern. That is, the
11:26:52 room flow patterns with and without the convection
11:26:54 device were nearly identical. A graphical image of
11:26:58 the inlet streamlines is shown in both foot and side
11:27:01 view in Figure 11."
11:27:03 **Q.** So you turned the Bair Hugger off?
11:27:05 **A.** That paragraph refers to me turning the Bair
11:27:08 Hugger off.

11:27:09 **Q.** Okay. So you ran the Bair Hugger off in the
11:27:12 publication.
11:27:12 **A.** That's correct.
11:27:14 **Q.** You didn't provide those results in your
11:27:16 expert report; correct?
11:27:17 **A.** No. And they are not relevant to the expert
11:27:20 report.
11:27:21 **Q.** But they weren't provided in the expert
11:27:22 report; correct?
11:27:23 **A.** They were not provided, and they were not
11:27:24 relevant because my expert report wanted to answer the
11:27:30 question does the Bair Hugger bring potentially
11:27:33 unclean air to the surgical site. And running a case
11:27:35 without the Bair Hugger is immaterial to that
11:27:38 question.
11:27:39 MR. ASSAAD: Move to strike the
11:27:40 nonresponsive portion of his answer.
11:28:05 **Q.** Going to page 5 of Exhibit 3, your article.
11:28:26 On the bottom paragraph you mention that "...over
11:28:32 2,000 time steps were made following the achievement
11:28:34 of the results already provided."
11:28:37 Were those time steps with the Bair Hugger
11:28:39 on?
11:28:40 **A.** Yes.
11:28:41 **Q.** Okay. So the results are the 264.TRN file;

11:28:47 correct?
11:28:48 **A.** Yes.
11:28:48 **Q.** And you ran it for another 2,000 time steps
11:28:51 after that; correct?
11:28:52 **A.** Yes.
11:28:54 **Q.** That wasn't provided in your expert report
11:28:56 that was submitted for general causation; correct?
11:28:58 **A.** That is correct.
11:28:58 **Q.** Okay. And how --
11:29:00 **A.** But what was provided was a statement to
11:29:02 this effect. I stated in my causation report that if
11:29:05 you looked at other time steps the results would not
11:29:08 -- would not materially change.
11:29:10 **Q.** So my understanding is --
11:29:13 Well let me ask you this: What was the time
11:29:15 step -- What was the time step, like how many seconds
11:29:20 between -- for each time step?
11:29:22 **A.** I don't recall.
11:29:22 **Q.** Would you have --
11:29:23 Would it have been at still .01 seconds?
11:29:26 **A.** It may have been.
11:29:27 **Q.** Okay. So if it was .01 seconds, we're
11:29:30 looking at another 20 seconds of simulation time.
11:29:33 **A.** That may be true.
11:29:34 **Q.** Okay. And when you ran it forward over

11:29:38 2,000 time steps did you have any problems with
11:29:40 convergence?
11:29:42 **A.** I did not --
11:29:44 I do not recall having any problems with
11:29:46 convergence.
11:29:47 **Q.** Were there any failures?
11:29:48 **A.** I do not recall any failures.
11:29:50 **Q.** And if there was a failure, that would be
11:29:52 something that you would recall; correct?
11:29:54 **A.** It is likely I would recall it, but I may
11:29:57 not recall it.
11:29:58 **Q.** Okay. So it's possible that your CFD could
11:30:00 have failed doing the 750?
11:30:02 **A.** I would say this. I do not recall it
11:30:04 failing doing the 750.
11:30:06 **Q.** But you're not saying it would not be
11:30:08 possible.
11:30:09 **A.** Anything is possible.
11:30:10 What I'm telling you is I do not recall any
11:30:12 failures when I ran these calculations.
11:30:15 **Q.** Okay. And if you look at -- if you continue
11:30:22 it talks about Figure 6 showing an approximately 2,500
11:30:27 time steps; correct?
11:30:28 **A.** Yes.
11:30:29 **Q.** So now you at least ran it 2,500 time steps;

11:30:33 correct?
11:30:34 **A.** Correct.
11:30:39 **Q.** In addition, in your published paper you
11:30:42 also ran the calculations at 43 degrees Celsius for
11:30:45 the Bair Hugger exit temperature; correct?
11:30:48 **A.** I'll clarify your question and then I'll
11:30:50 answer it. The Bair Hugger is set at 43. What that
11:30:54 means is the air going from the hose into the blanket
11:30:58 is 43 Celsius. Now the -- when the air comes out of
11:31:03 the blanket it's not 43 any more, it varies depending
11:31:06 on where you are, but it varies typically between 41
11:31:10 and the low 30s. Okay. So 41 degrees is the highest
11:31:20 temperature the air exits the blanket, 43 degrees is
11:31:26 the air temperature into the blanket.
11:31:28 So we just have to be clear when we say "the
11:31:30 Bair Hugger temperature." There is more than one
11:31:33 temperature.
11:31:33 **Q.** I understand that.
11:31:34 You also ran the CFD model with the exit
11:31:37 temperature out of the Bair Hugger blanket at 43
11:31:40 degrees Celsius.
11:31:41 **A.** That is correct.
11:31:41 **Q.** Okay. So you ran it both at 41 degrees
11:31:44 Celsius and at 43 degrees Celsius; correct?
11:31:46 **A.** Correct.

11:31:46 **Q.** Have you provided those TRN files?
11:31:48 **A.** No.
11:31:49 **Q.** Where are those TRN files?
11:31:53 **A.** I would not have them any more because I don't need to keep them. I have the master file.
11:31:57 **Q.** So you have the master file for 43 degrees Celsius?
11:32:01 **A.** I have the master file that can be used to recreate any of these results. I don't keep the individual snapshots, but I keep the 264 TRN, which can be used to recreate all of this.
11:32:13 **Q.** So was the 2540 TRN file created off the 264.TRN file?
11:32:20 **A.** What does "created off" mean?
11:32:22 **Q.** You said --
11:32:23 You said you have the 264 TRN file that you could create all these scenarios off of; correct?
11:32:29 **A.** Yes.
11:32:30 **Q.** So was the TRN file 2540.TRN, was that created from the 26 -- except for the boundary conditions, was everything else there from the 264.TRN file?
11:32:44 **A.** The 254 --
11:32:46 The 2540 and the 264 are identical except for the flow rate of the Bair Hugger.

11:32:57 **Q.** And how long did you run the simulation for 43 degrees Celsius?
11:33:01 **A.** I don't recall. But I would have run it until quasi-steady state was achieved.
11:33:04 **Q.** So just so I understand it, you have results here in your published paper, Exhibit 3, for 900 time steps; correct? Which is (a) and (b) of the diagram.
11:33:23 **A.** Well it says "approximately 900."
11:33:27 **Q.** Okay. And you also have results for your time steps of 2500 time steps in your published paper, Exhibit 3.
11:33:31 **A.** Yeah, and it's "approximately 2,500." And they're shown in figures 6 (a), (b), (c) and (d).
11:33:38 **Q.** I understand that.
11:33:40 Can you just please answer my question?
11:33:42 **A.** Well I think I did.
11:33:48 **Q.** I didn't ask you where were they shown. I just asked you did you have it in your published paper.
11:33:48 Finally, you -- the mesh that is depicted on your published paper, Exhibit 3, Figure Number 3, is a 60-million-cell mesh; correct?
11:33:51 **A.** I believe that's true.
11:33:55 **Q.** And that was not used to get the results of the graphs or the figures of Figures 4, 5, 6 and 7;

11:33:55 correct?
11:33:57 **A.** That's incorrect.
11:33:58 So what happens is you have to demonstrate your results are mesh independent. And what that means is --
11:34:00 **Q.** I know what that means. But did -- Are those -- Withdraw that question.
11:34:02 The -- The Figure 4. Figure 4, those diagrams of streamlines, were they created off a mesh of 60 million cells, 12 million cells, or is it 9 million cells?
11:34:11 **A.** If I recall correctly, these were created using a mesh of 9 to 10 million cells.
11:34:19 **Q.** Okay. And the same question for Figure 4.
11:34:22 **A.** You just asked for Figure 4.
11:34:23 **Q.** Oh. Figure 5. I'm sorry.
11:34:27 **A.** Same answer.
11:34:36 **Q.** Figure 6?
11:34:37 **A.** Same answer.
11:34:37 **Q.** Figure 7?
11:34:40 **A.** Same answer.
11:34:44 **Q.** Figure 8?
11:34:44 **A.** Same answer.
11:34:48 **Q.** Figure 9?
11:34:50 **A.** Same answer.

11:34:57 **Q.** Figure 10?
11:35:02 **A.** Same answer.
11:35:08 **Q.** Figure 11?
11:35:09 **A.** Same answer.
11:35:12 **Q.** Is there anywhere in your published paper that indicates that the mesh used to get those results of Figures 4, 5, 6, 7, 8, 9, and 10 is not the mesh that's depicted in Figure 3?
11:35:16 **A.** What I say in the paper is, "To achieve accuracy, multiple mesh deployments were used up to approximately 60 million elements." Now what that means is multiple mesh sizes were used. There is the expectation, the reader has the expectation that this means I achieved mesh independence, okay?
11:35:21 **Q.** My question is specifically: Is there anywhere in your paper that indicates that the mesh that was used to obtain the results in Figures 4 through 10 is not the same mesh that is depicted in Figure 3?
11:35:23 **A.** I'm answering your question.
11:35:24 **Q.** It's a simple "yes" or "no."
11:35:27 **A.** It is not a simple "yes" or "no."
11:35:29 **Q.** If you can't answer that question, just let me know, but I want a "yes" or "no."
11:35:31 **A.** I can answer the question. It is not a

simple "yes" or "no." Would you like me to answer the question?

Q. No. If it's not a simple "yes" or "no," I don't want --

If it's not in there, that's fine; if it's in there, you could show it to me. But I don't need a --

A. No. Hold --

Q. I don't need an explana --

A. You just did a bait and switch.

Q. I don't need an explanation of why you think a reader might interpret it that way.

Is there anywhere that it's specifically written in your report that Figures 4 through 10, that the mesh utilized to create those figures is not the 60 million mesh depicted in Figure 3?

MR. GOSS: I'm just going to object to form. I'm not seeing that Figure 3 says anything about 60 million mesh. But subject to that, if you have a different answer, go ahead.

A. Can you re-ask the question?

Q. You know what, I will move on.

Your peer-reviewed report was published in August of 2017?

A. I don't recall the date it actually

appeared.

Q. Well on the first page it says published August 8th, 2017.

First page. Like, there's a calendar picture.

A. Oh.

MR. GOSS: [Indicating.]

A. So it was published online August 8th, 2017.

Q. So your peer-reviewed report was published after we had your deposition in the general causation case; correct?

A. That is correct.

Q. And*Numerical Heat Transfer*, is that a peer-reviewed publication?

A. Yes. I would say it's the top journal in the field.

Q. Okay. That wasn't my question, sir.

A. Well I answered your question "yes."

Q. Okay. Did you submit your paper to any other publication?

A. No.

Q. And your paper was peer reviewed; correct?

A. Correct.

Q. Did you receive any comments from any peer reviewers?

A. I received the acceptance letter from the editor-in-chief.

Q. That wasn't my question.

A. No.

Q. Do you know who reviewed your paper?

A. I do not.

Q. Do you know how many people reviewed your paper?

A. I do not.

Q. Do you know if anyone reviewed your paper?

A. Yes.

Q. How do you know people reviewed your paper?

A. Well the acceptance letter says the paper was reviewed.

Q. Do you know the type of review process exists for*Numerical Heat Transfer*?

A. I do not.

Q. Do you know what a double-blind review process is?

A. Yes, I do.

Q. What is a double-blind review process?

A. A double-blind review process is when papers are sent out to reviewers and the reviewers don't know the authors and the authors don't know the reviewers.

Q. So when you submit -- when you submitted

your paper did you have to make any changes before -- requested by the -- by the publication?

A. I don't recall if I made any changes.

Q. Okay. So there weren't any questions or changes by any of the reviewers.

A. I don't recall.

Q. Now Ms. Vallez is a co-author of the paper; correct?

A. Correct.

Q. And she did not make any significant contribution to the paper; correct?

A. I wrote the pa...

I wrote the entire paper.

Q. So you agree with me that she did not make a significant contribution.

A. If she made a contribution, it would have been very minor.

Q. I mean, according to your testimony in general cause, she provided no work or calculations with respect to the CFD analysis; correct?

A. That's --

That's not true. I think what I said was she provided nothing meaningful, or she provided very little.

Q. Can you turn to page 40 of your deposition,

Exhibit Number 4.
A. (Witness complying.)
Q. Question, Line 3:
"Did Mr. Plourde or Ms. Vallez provide any work with respect to the CFD analysis you performed on the 750?
ANSWER: No."
Was that your testi --
A. I --
Q. Was that your testimony back then?
MR. GOSS: I'm just going to object to the improper impeachment, I don't think it's inconsistent with what he said, but you can answer.
A. That's what it says, but I recall saying that they weren't -- they did not provide any meaningful work, they didn't provide any meaningful contributions to the 750.
Q. Okay. Well if you want to turn to page 42, and look at line 15.
A. Yeah.
Q. Is that where you recall saying, "The problem was too complex and the timeline was too short for him to contribute meaningfully"?
A. That's what it says.

Q. So Mr. Plourde did not contribute anything meaningfully to this paper.
A. That is correct.
Q. Because it was too complex for him.
A. Well I say here it was complex and short timeline.
Q. And it was too challenging for Ms. Vallez.
A. Well what I say in this deposition page 42 is she -- lines 2 through 4. "It turns" --
Q. Well why don't you --
Why don't you read line 1 as well --
A. Okay.
Q. -- because that's a really good line.
A. She actually --
I'll start with line 1 and I'll read through line 6.
"She actually didn't accomplish anything. The -- It turns out the simulation was very challenging... she wasn't able to contribute meaningfully in any way. She didn't contribute in any way to the generation of the mesh, to the setting of the boundary conditions, and to the analysis."

And I think that's consistent with what I just said here.
Q. Okay. But nevertheless, you put her name and Mr. Plourde's name on the -- on the publication.
MR. GOSS: Object to form.
A. That is correct.
MR. ASSAAD: Basis?
MR. GOSS: I don't know that he put his name on it.
Q. Well you submitted the -- the publication; correct?
A. That is correct.
Q. And all correspondence with respect to this com -- this publication, Exhibit 3, is directed to you; correct?
A. Correct.
Q. And you're the lead author of this publication; correct?
A. Correct.
Q. Why did you add them to the journal?
A. Because they tried, and when students try, but if a professor has to step in and complete the work, I think it's just right to include them.
And I actually want to correct the record.
Q. There's no question pending.

A. Well I'm going to correct the record anyways unless you instruct me not to.
Q. There's no question pending.
MR. ASSAAD: Counselor, can you please --
MR. GOSS: You can wait. You can wait, John.
THE WITNESS: Okay.
BY MR. ASSAAD:
Q. Are you familiar that Taylor & Francis are the publishers for*Numerical Heat Transfer*?
A. Yes.
Q. Have you looked at any of their publications with respect to avoiding unethical authorship on the journal?
A. I may have. I don't recall if I did.
(Abraham Exhibit 5 marked for identification.)
BY MR. ASSAAD:
Q. Exhibit 5 is a document from Taylor Francis under -- from Editor Resources titled, "Avoiding unethical authorship on your journal."
And I would like you to turn to page 2 that defines a co-author as any person who made a significant contribution to a journal and who shares responsibility and accountability for the results.

11:46:50 Did I read that correctly?
11:46:52 **A.** Yes, you did.
11:46:55 **Q.** Do you agree with me that Mr. Plourde and
11:46:57 Ms. Vallez did not make any significant contribution
11:46:59 to the work; correct?
11:47:00 **A.** I disagree.
11:47:01 **Q.** So you disagree with your prior testimony.
11:47:03 **A.** No, I don't.
11:47:05 **Q.** Do you think "meaningful" and "significant"
11:47:07 mean two different things?
11:47:08 **A.** You are confused.
11:47:10 **Q.** I am not --
11:47:10 **A.** If you would allow me --
11:47:10 **Q.** -- confused, sir.
11:47:10 **A.** If you would --
11:47:11 **Q.** Don't tell me what I am or am not. Okay?
11:47:15 MR. GOSS: Can you just answer his --
11:47:17 **Q.** Answer my question.
11:47:19 **A.** Mr. Plourde --
11:47:21 If you read the first item here, first of
11:47:23 all, they have made significant contributions to the
11:47:27 work reported, whether it's in the research conception
11:47:30 or design, acquisition of data, analysis and
11:47:33 interpretation, or in all of these areas.
11:47:37 And what we read from my deposition was

11:47:39 related to the actual CFD calculations, but you have
11:47:42 to recognize there's more in here than the
11:47:44 calculations. There's an entire section in this paper
11:47:49 on experimental validation, and I want to turn our
11:47:53 attention to Figure 12. Mr. Plourde is shown in
11:47:57 Figure 12. Mr. Plourde is shown in Figure 13. So
11:48:03 regardless of whether he made any contributions to the
11:48:05 CFD, I'm obligated to include him as a co-author.
11:48:09 Now with respect to Ms. Vallez --
11:48:11 **Q.** Excuse me. Excuse me.
11:48:12 Figures 12 and 13, who are those other
11:48:14 people in the room?
11:48:19 **A.** In Figure 12 I see two -- I see three people
11:48:24 -- actually I see four, I apologize. There is a -- I
11:48:29 see five.
11:48:31 On the -- Let's go from right to left.
11:48:33 **Q.** Well let me ask it this way. I'm going to
11:48:35 try to be quick here. Are any of those five --
11:48:38 Are all those five people listed as authors?
11:48:40 **A.** No.
11:48:41 **Q.** Okay. Then let's go to Figure 13. Are all
11:48:44 the people in -- in Figure 13 listed as authors?
11:48:47 **A.** They are not.
11:48:48 **Q.** Okay. Let's move on.
11:48:54 MR. ASSAAD: Let's take a break, actually.

11:48:57 THE REPORTER: Off the record, please.
11:48:58 (Recess from 11:48 a.m. to 12:00 p.m.)
12:00:29 BY MR. ASSAAD:
12:00:50 **Q.** I'd like to turn to -- Strike that.
12:00:57 MR. ASSAAD: Have to mark it first.
12:00:58 (Abraham Exhibit 6 marked for
12:00:58 identification.)
12:00:58 BY MR. ASSAAD:
12:01:10 **Q.** What's been marked as Exhibit 6 is a CV that
12:01:15 was provided to us along with your expert report in
12:01:19 this case.
12:01:22 Can you please review it to let me know if
12:01:24 this is an up to date CV?
12:01:28 **A.** It would have been up to date at the time it
12:01:30 was submitted. There may have been more publications,
12:01:33 for instance, that have occurred since then, but this
12:01:37 would have been up to date at the time it was
12:01:39 submitted.
12:01:40 **Q.** And at the time it was submitted would this
12:01:43 be an accurate summary of all your publications?
12:01:50 **A.** Yes. I -- I sure hope I have them all here.
12:01:54 But yes, at the time of this submission I would expect
12:01:57 that all my publications would be listed here.
12:02:00 **Q.** All right. Have you yourself ever used a
12:02:04 supercomputer with respect to any of your

12:02:06 publications?
12:02:07 **A.** Yes.
12:02:08 **Q.** Which ones?
12:02:24 **A.** So in the journal publication list which
12:02:26 goes up to 156, it would be items 154, I think 150,
12:02:40 149, 148, and I think 146.
12:02:51 **Q.** Any others?
12:02:51 **A.** Not that I recall now.
12:02:52 **Q.** So the last time you used a supercomputer
12:02:55 would have been 2004, for any of your publications?
12:02:57 **A.** That's to my best recollection.
12:02:59 **Q.** And what supercomputer did you use?
12:03:01 **A.** It would have been a supercomputer at the
12:03:05 University of Minnesota Supercomputing Institute.
12:03:08 **Q.** Okay. Do you know how many cores that
12:03:10 supercomputer had?
12:03:11 **A.** No, I do not recall how many cores.
12:03:11 **Q.** And was --
12:03:14 Was it dealing with CFD?
12:03:15 **A.** Yes.
12:03:16 **Q.** Do you know what code was used on the
12:03:18 supercomputer?
12:03:19 **A.** Yes.
12:03:20 **Q.** What code?
12:03:21 **A.** ANSYS Fluent.

12:03:22 **Q.** Okay. On all of them?
12:03:26 **A.** Yes.
12:03:30 **Q.** Do any of your publications consist of a
12:03:40 supercomputer -- Strike that.
12:03:43 Any of your publications deal with any CFD
12:03:46 modeling that you did with any other code besides
12:03:50 ANSYS?
12:03:57 **A.** I've used three different codes, and I've
12:04:00 used my own code.
12:04:02 **Q.** What are the three codes?
12:04:04 **A.** Flotran, F-L-O-T-R-A-N --
12:04:15 (Interruption by the reporter.)
12:04:15 **Q.** And just to make things quicker, if she has
12:04:18 trouble spelling anything she'll ask you later on, so
12:04:20 you don't have to spell everything out.
12:04:22 **A.** Thank you. Sorry.
12:04:23 CFX, Fluent.
12:04:26 **Q.** And CFX and Fluent now are owned by ANSYS;
12:04:29 correct?
12:04:30 **A.** Correct.
12:04:34 **Q.** Have you ever used a non-commercially
12:04:37 available code besides your own code?
12:04:41 **A.** No.
12:04:43 **Q.** What publication did you use your --
12:04:45 **A.** Let me take that back.

12:04:47 Yes.
12:04:48 **Q.** What code?
12:04:50 **A.** I don't know the name of the code, but it
12:04:53 was code written by a person named Suhas Patankar.
12:04:59 **Q.** And when did you use that?
12:05:02 **A.** During my doctoral studies.
12:05:04 **Q.** And who is Suhas Patankar?
12:05:08 **A.** He was the computational fluid dynamics
12:05:10 professor.
12:05:11 **Q.** At the University of Minnesota?
12:05:12 **A.** Yes.
12:05:14 **Q.** And so that would have been during your
12:05:18 doctorate?
12:05:20 **A.** Yes.
12:05:21 **Q.** Which would have been prior to 2002.
12:05:25 **A.** Yes.
12:05:25 **Q.** Okay. Has --
12:05:28 Did you publish anything with the use of
12:05:30 that code?
12:05:31 **A.** No.
12:05:32 **Q.** Okay. So you just took it as part of a
12:05:36 class.
12:05:37 **A.** Yes.
12:05:38 **Q.** Was that one semester or two semesters?
12:05:41 **A.** Two. And it may have been quarters at that

12:05:43 time.
12:05:43 **Q.** Okay. Two quarters?
12:05:45 **A.** Or two semesters.
12:05:47 **Q.** Okay. You mentioned that you have your own
12:05:59 code; correct?
12:06:01 **A.** No. I mentioned that I've used my own code.
12:06:04 So I've written code for problems as well.
12:06:07 **Q.** Okay. Have you written code for CFD?
12:06:10 **A.** Yes.
12:06:11 **Q.** And have you used that code in any of your
12:06:14 publications?
12:06:16 **A.** No.
12:06:17 **Q.** When was the last time you used that code
12:06:18 for anything?
12:06:28 **A.** I don't recall. I would estimate a decade
12:06:30 or longer ago.
12:06:32 **Q.** Does that code still exist?
12:06:33 **A.** No.
12:06:35 **Q.** And was that code used on a supercomputer?
12:06:38 **A.** No.
12:06:43 **Q.** Do you know the process to have the ability
12:06:48 to use a code on a supercomputer?
12:06:52 **A.** Yes.
12:06:52 **Q.** What is the process?
12:06:56 **A.** I can tell you the process I used, which was

12:06:59 the process at Minnesota. Other institutes may have
12:07:03 different processes.
12:07:04 But I was a research fellow at the
12:07:06 University of Minnesota in their Supercomputing
12:07:10 Center, which means I had the latitude, I was allowed
12:07:13 to submit jobs on their computers. And you would
12:07:17 submit them -- It was all done remotely. You'd submit
12:07:21 your jobs remotely and then the results would come
12:07:24 back and then you would look at them.
12:07:25 **Q.** I understand that.
12:07:26 But do you know how --
12:07:27 Do you know how many supercomputers there
12:07:29 are in the United States?
12:07:31 **A.** I do not know.
12:07:32 **Q.** Do you know the process, for example, if you
12:07:34 want to use the supercomputer in Illinois or down in
12:07:39 Texas, the process to qualify your code to be used on
12:07:49 the supercomputer?
12:07:50 **A.** I do not.
12:07:51 **Q.** Okay. Do you know what a petascale is?
12:08:02 **A.** Yes.
12:08:02 **Q.** What's a petascale?
12:08:04 **A.** It is -- I --
12:08:07 I think it's 10 to the 12, so a one with 12
12:08:12 zeros.

12:08:12 **Q.** And do you know how that term is used in
12:08:15 supercomputing?
12:08:19 "Yes" or "no"?
12:08:20 **A.** It could be used in different forms. It
12:08:21 could be used by RAM, by hard drive storage, or by
12:08:26 computational quantity, so it's how many calculations
12:08:29 are carried out per second. So it could be used in
12:08:31 many different --
12:08:33 **Q.** Are you guessing, or do you know?
12:08:34 **A.** No. I'm --
12:08:36 It could be used in different terms. So,
12:08:39 for example, I could have a hard drive that is a
12:08:45 terabyte and a tera stands for a quantity. I could
12:08:48 have RAM, which is different from hard drive, which is
12:08:51 a gigabyte. Or I could have a processor which is a
12:08:55 gigahertz. So when you -- you're using peta as the
12:08:57 prefix, you have to apply that peta to something. So
12:09:01 if you say petahertz it means something, if you say
12:09:05 petagigs it means something else.
12:09:07 **Q.** Well I'm using the term petascale.
12:09:09 Do you know what petascale means?
12:09:11 **A.** I do, and I answered that. A petascale is a
12:09:13 numerical quantification, so like million, billion,
12:09:16 quadrillion.
12:09:18 **Q.** Of what?

12:09:19 **A.** Well, it depends. So, for example, a hard
12:09:20 drive would be --
12:09:20 **Q.** We're not --
12:09:21 We're not talking about hard drives here,
12:09:23 sir. We're talking about supercomputers.
12:09:25 MR. GOSS: You didn't let him finish his
12:09:26 answer.
12:09:26 **Q.** Well we're not talking about hard drives,
12:09:28 we're talking about supercomputers, so let's stick to
12:09:28 the question.
12:09:30 Do you know how the term petascale is used
12:09:32 in the supercomputing world?
12:09:34 **A.** I'm telling you it's used in different
12:09:36 contexts.
12:09:37 **Q.** Okay.
12:09:37 **A.** For example, in a supercomputer you may talk
12:09:39 about storage, RAM, or calculation speed.
12:09:44 **Q.** Do you know what the petascale is of the
12:09:48 University of Minnesota supercomputer?
12:09:50 **A.** I do not.
12:09:51 **Q.** Do you know what the petascale is of the
12:09:53 University of Texas supercomputer?
12:09:55 **A.** I do not.
12:10:01 **Q.** What code did you write your --
12:10:04 What type of language did you write your

12:10:06 code in?
12:10:07 **A.** Likely Fortran.
12:10:10 **Q.** Which Fortran?
12:10:11 **A.** Either 77 or 91.
12:10:19 **Q.** And to write code, such as in Fortran, you
12:10:25 have to understand and use the underlying equations,
12:10:30 for example, in fluid dynamics; correct?
12:10:32 **A.** Correct.
12:10:41 **Q.** Who is Dr. Sparrow?
12:10:43 **A.** He's a professor at the University of
12:10:45 Minnesota, and he's my formal -- former doctoral
12:10:52 advisor.
12:10:52 **Q.** Do you still communicate with him?
12:10:54 **A.** Occasionally.
12:10:55 **Q.** When you say "occasionally," how often is
12:10:57 occasionally?
12:10:58 **A.** Perhaps once a month.
12:11:01 **Q.** What about Dr. Minkowycz; do you know who he
12:11:05 is?
12:11:06 **A.** Yes, I do.
12:11:07 **Q.** Who's he?
12:11:07 **A.** He's a professor at the University of
12:11:09 Illinois, Chicago.
12:11:11 **Q.** Was he ever at the University of Minnesota?
12:11:15 **A.** I believe he did his doctoral work at the

12:11:17 University of Minnesota.
12:11:18 **Q.** Do you know him?
12:11:19 **A.** I have met him once, but we've communicated
12:11:23 by email.
12:11:24 **Q.** How often do you communicate with him?
12:11:26 **A.** It depends. Maybe once every three months.
12:11:35 **Q.** And you've communicated with him a lot in
12:11:37 the past; correct?
12:11:39 MR. GOSS: Object to form.
12:11:40 **A.** I don't know what "a lot" is. I -- I would
12:11:42 say I communicate with him once every three months I'd
12:11:45 guess.
12:11:46 **Q.** I mean you've known him since at least 2009;
12:11:54 correct?
12:11:54 **A.** Yes.
12:11:59 **Q.** And he is the editor-in-chief of*Numerical*
12:12:02 *Heat Transfer*; correct?
12:12:03 **A.** That is correct.
12:12:03 **Q.** Do you know how long he's been the
12:12:05 editor-in-chief?
12:12:06 **A.** I do not know.
12:12:07 **Q.** And Dr. Sparrow is the chairman of the -- of
12:12:15 the editors for*Numerical Heat Transfer*; correct?
12:12:19 **A.** That may be true.
12:12:24 **Q.** Chairman of the Editorial Advisory Board.

12:12:26 **A.** That may be true.
12:12:29 **Q.** Okay. And you guys are friends, correct, with Dr. Sparrow?
12:12:33 **A.** Yes, I would call Dr. Sparrow a friend.
12:12:34 **Q.** Would you call Dr. Minkowycz a friend?
12:12:36 **A.** I'm...
12:12:39 Boy, I don't know. Perhaps. I don't know.
12:12:40 **Q.** You published a lot with Dr. Minkowycz and Dr. Sparrow; correct?
12:12:51 **A.** Yes, I have.
12:12:53 **Q.** And in fact if we go to your publications, we could start off with your books, and in 2011 you authored a book with Dr. Sparrow and Dr. Minkowycz; correct?
12:12:54 12:12:55 12:13:02 12:13:07 12:13:10
12:13:18 **A.** Yes.
12:13:19 **Q.** And if you look at "Book Chapters," you authored one, two, three, four, four book chapters with Dr. Minkowycz; correct?
12:13:21 12:13:29
12:13:31 **A.** That is correct.
12:13:34 **Q.** Between 2011 and the present; correct?
12:13:38 **A.** Correct.
12:13:39 **Q.** And you authored one, two, three, four, five book chapters with Dr. Sparrow; correct?
12:13:45
12:13:48 **A.** Correct.
12:13:48 **Q.** Between 2005 and 2017; correct?

12:13:51 **A.** Correct.
12:13:56 **Q.** Now with "Publications," if you look at number 10, you authored an article with Dr. Sparrow and Dr. Minkowycz in 2017.
12:13:58 12:14:01
12:14:04 **A.** That is correct.
12:14:06 **Q.** And if you look at number 17, you authored another article with Dr. Minkowycz and Dr. Sparrow again in 2017.
12:14:08 12:14:10
12:14:12 **A.** Which number are you mentioning?
12:14:14 **Q.** 17.
12:14:15 **A.** That is correct.
12:14:17 **Q.** And if you look at number 22, you authored another article in 2016 with Dr. Minkowycz and Dr. Sparrow.
12:14:22 12:14:26
12:14:26 **A.** Correct.
12:14:27 **Q.** And that was in*Numerical Heat Transfer*; correct?
12:14:30 12:14:30 **A.** Correct.
12:14:30 **Q.** And that's*Numerical Heat Transfer B.*
12:14:33 **A.** Correct.
12:14:34 **Q.** Is Dr. Minkowycz the editor-in-chief of *Numerical Heat Transfer B*?
12:14:39
12:14:42 **A.** Yes.
12:14:47 **Q.** On number 23 of your publications you authored an article with Dr. Sparrow in 2016; correct?
12:14:49

12:14:53 **A.** Correct.
12:14:56 **Q.** Turning to the next page.
12:14:58 Number 29 you have another article with Dr. Minkowycz and Dr. Sparrow in 2016; correct?
12:15:01
12:15:04 **A.** Correct.
12:15:05 **Q.** And I assume that when you write articles together you have communications with each other.
12:15:08
12:15:11 **A.** Yes.
12:15:12 **Q.** And probably numerous communications regarding the article.
12:15:14
12:15:15 **A.** Not necessarily.
12:15:20 **Q.** Would you have more than one communication?
12:15:22 **A.** Likely.
12:15:28 **Q.** How did you and Dr. Minkowycz begin to start publishing together?
12:15:32
12:15:34 **A.** Well he's one of the best in the field. I mean, in this area of*numerical heat transfer* he may be the best. And that's reflected by his position in industry. He's the editor-in-chief of, as you pointed out,*Numerical Heat Transfer*, which is the top *numerical heat transfer* journal. He's also the editor-in-chief of*International Journal of Heat Mass Transfer,*which is the top journal in that field. And he's also the editor-in-chief of*International Communications in Heat Mass Transfer*. So it is only
12:15:37 12:15:41 12:15:45 12:15:48 12:15:51 12:15:53 12:15:57 12:15:59 12:16:03

12:16:07 -- I guess I -- it's expected you would work with the best, so that's how.
12:16:10
12:16:12 MR. ASSAAD: Move to strike.
12:16:13 Counsel, can you please instruct your witness to answer my questions? I did not ask -- I didn't ask how well known or how good Dr. Minkowycz is.
12:16:15 12:16:17 12:16:20
12:16:20 **Q.** I asked: How did you become involved in publishing with Dr. Minkowycz?
12:16:23
12:16:25 **A.** Because we work in similar fields on similar problems.
12:16:26
12:16:27 **Q.** At what point in time were you first introduced to Dr. Minkowycz?
12:16:28
12:16:30 **A.** I would go back to my reference list and I'd find the earliest one. If you would like me to do that, I can do it.
12:16:32 12:16:34
12:16:35 **Q.** So it would go from your early --
12:16:37 So the first time you started doing work with Dr. Minkowycz was probably about the time of your first publication with him?
12:16:44 12:16:47
12:16:49 **A.** Yes.
12:16:49 **Q.** Who introduced you to Dr. Minkowycz?
12:16:51 **A.** It would have been Dr. Sparrow.
12:16:54 **Q.** Are Dr. Sparrow and Dr. Minkowycz good friends?
12:16:56

12:16:58 **A.** I think they are.
12:17:03 **Q.** Number 35 you have a journal article talking
12:17:16 about patient-warming blankets that was published in
12:17:20 *Numerical Heat Transfer A*?
12:17:21 **A.** Yes.
12:17:22 **Q.** And you did that with Ms. Vallez and Mr.
12:17:26 Plourde; correct?
12:17:27 **A.** Correct.
12:17:29 **Q.** Was that peer reviewed?
12:17:30 **A.** Yes.
12:17:31 **Q.** Do you recall whether or not there were any
12:17:33 comments from the editors in that article?
12:17:34 **A.** I don't recall.
12:17:36 **Q.** You have received, in the past, comments
12:17:37 from reviewers; correct?
12:17:39 **A.** Yes.
12:17:40 **Q.** Whether they want to make changes or have
12:17:42 questions; correct?
12:17:44 **A.** Yes.
12:17:45 **Q.** Or any type of comments; correct?
12:17:47 **A.** Correct.
12:17:48 **Q.** That's usually how this occurs with peer
12:17:50 review, they review it and offer comments; correct?
12:17:52 **A.** Correct.
12:17:52 **Q.** And most of the time you do receive comments

12:17:54 from reviewers; correct?
12:17:55 MR. GOSS: Object to form.
12:17:57 **A.** I don't know if it's most of the time. I
12:17:59 mean, I haven't counted. Sometimes papers are
12:18:01 accepted as is, sometimes papers are rejected, and
12:18:04 sometimes papers are commented on.
12:18:09 **Q.** You've been a reviewer; correct?
12:18:10 **A.** Yes.
12:18:11 **Q.** Do you usually --
12:18:13 Or do you regularly provide comments to what
12:18:14 you review?
12:18:16 **A.** Yes, I regularly provide comments.
12:18:20 **Q.** Whether it was, this is a fascinating paper,
12:18:22 or an interesting paper, or if you have questions;
12:18:24 correct?
12:18:26 **A.** I would say I regularly provide comments. I
12:18:28 don't know if I've ever written this is a fascinating
12:18:30 paper or an interesting paper, but I would say I
12:18:33 regularly provide comments.
12:18:34 **Q.** And when you are asked to review a paper,
12:18:37 you actually review the paper and read it; correct?
12:18:39 **A.** I tend to review very thoroughly. So yes, I
12:18:42 do review papers.
12:18:43 **Q.** Okay. What percentage of papers that you
12:18:52 review that you provide no comments? And an estimate

12:18:57 is okay.
12:19:01 **A.** Maybe twenty percent.
12:19:07 **Q.** Okay. Now number 38 you published with Dr.
12:19:14 Sparrow again in 2015.
12:19:17 **A.** Yes.
12:19:18 **Q.** And in 20 --
12:19:20 And number 45 you published with Dr.
12:19:22 Minkowycz in 2015.
12:19:23 **A.** Correct.
12:19:27 **Q.** And you would agree with me that you publish
12:19:34 regularly with Dr. Sparrow and Dr. Minkowycz.
12:19:37 **A.** Yes.
12:19:48 **Q.** And number 46 you published with Dr. Sparrow
12:19:50 in 2015; correct?
12:19:53 **A.** That is correct.
12:19:54 **Q.** And number 47 you also published with Dr.
12:19:57 Sparrow in 2015.
12:20:02 **A.** Correct.
12:20:03 **Q.** And number 52 you published with Dr.
12:20:07 Minkowycz in 2015.
12:20:08 **A.** Correct.
12:20:12 **Q.** And in number 60, in 2014, you published
12:20:14 with Dr. Minkowycz.
12:20:16 **A.** Correct.
12:20:34 **Q.** So between 2014 and the present you

12:20:41 published with Dr. Minkowycz seven publications and
12:20:59 three book chapters; is that correct?
12:21:02 That sound about right?
12:21:03 **A.** Yes, it does.
12:21:04 **Q.** And you've published more with Dr. Sparrow
12:21:07 than Dr. Minkowycz in that period of time.
12:21:09 **A.** That is correct.
12:21:57 **Q.** You mentioned that when you are a peer
12:21:59 reviewer you are very thorough when you review an
12:22:05 article.
12:22:06 **A.** Yes.
12:22:06 **Q.** What did you mean by that?
12:22:08 **A.** I read the articles thoroughly.
12:22:10 **Q.** And do you read it right when you get it
12:22:12 thoroughly, or do you have time?
12:22:13 **A.** I try to read them right away, because
12:22:17 authors -- sometimes a paper can languish in review
12:22:22 and it's not fair to the authors, so I try to do it
12:22:25 within a few days.
12:22:28 **Q.** And do you know why you're picked, like how
12:22:31 you get chosen for each paper that you review?
12:22:33 **A.** Yes.
12:22:34 **Q.** What's the process?
12:22:36 **A.** Typically the process is I'm deemed an
12:22:39 expert in that area, someone who is able to review a

paper.
Q. And that's the editor-in-chief that decides who reviews?
A. It may be. It may be an associate editor.
Q. But it's someone on the editorial board.
A. Typically that's how it works. And sometimes an editor does the review, so I edit books, and in that case I review.
Q. Just for the record, Exhibit Number 3 is your peer-reviewed published report in this case; correct?
MR. GOSS: Object to form.
MR. ASSAAD: Basis?
MR. GOSS: Well it's not identical to his report.
MR. ASSAAD: My fault.
Q. Exhibit 3 is your peer-reviewed publication that was published in*Numerical Heat Transfer*.
A. Yes.
Q. Okay. And that was submitted to*Numerical Heat Transfer* on May 4th, 2017; correct?
A. I believe that's true.
Q. Okay. Even though it says on the article that it was received on April 24th, 2017.
A. I would defer to this -- the article

statement then, the April 24th.
Q. And the article also says that it was accepted on June 16th, 2017; correct?
A. Yes.
Q. But it was actually accepted on May 31st, 2017; correct?
A. I don't know. All I can see is that it's listed here as accepted June 16th.
(Abraham Exhibit 7 marked for identification.)
BY MR. ASSAAD:
Q. Do you recognize Exhibit 7?
A. Yes, I do.
Q. Exhibit 7 is your acceptance letter from Dr. Minkowycz with respect to the acceptance of the article which is Exhibit 3; correct?
A. It is, but what it says here is "...I intend to accept your work for publication." So this is a statement on May 31st saying I intend to accept your work for publication, but it's not the final acceptance.
Q. You're talking about the first line of paragraph two; correct?
A. Yes, I am.
Q. And that's after the line from paragraph one

that says, "Indeed the quality standard of the paper merits its acceptance for publication..."
A. Yes.
Q. And if you go to page 2 of Exhibit 7, this is a form that was filled out by Dr. Minkowycz; correct?
A. I don't know who filled out this form.
Q. Did you fill out this form?
A. I did not fill out this form.
Q. And this was attached to the letter; correct?
A. I don't recall if it was attached to the letter. It may have been.
Q. Well I represent to you that this entire document came as one PDF from -- from defense counsel. Is there any reason for you to believe that it's not one document that's together?
A. No. There's no reason for me to believe it's not one document.
Q. Okay. And pages 3 and 4 discuss the final checklist, talking about the processing of manuscripts; correct?
A. Yes.
Q. And that's for publication; correct?
A. Yes.

Q. So you agree with me that based on Exhibit Number 7, the transcript was received by*Numerical Heat Transfer* on May 4th, 2017.
A. I disagree.
Q. It says manuscripts -- manuscript date details, date manuscript received, it says May 4th, 2007. Is that what it says there?
A. That's --
MR. GOSS: 2017; correct?
MR. ASSAAD: 2017.
A. That is what --
That is the date entered on this form.
Q. Okay.
A. May 4th, 2017.
But it's not the acceptance -- it's not the reception date of April 24th.
Q. Well you agree that it says May 4th, 2017 on this form that was filled out by*Numerical Heat Transfer*.
A. I agree that's what the form says.
Q. And you'll agree that by May 31st, 2017 Dr. Minkowiycz accepted your paper.
A. I would agree to what's written in the letter, which says he intends to accept it. But the final article was accepted June 16th.

12:28:32 **Q.** Do you have any documentation to show that
12:28:33 it was accepted June 16th?
12:28:35 **A.** Yes.
12:28:35 **Q.** Where?
12:28:36 **A.** It's on this journal paper.
12:28:38 **Q.** Not talking on the journal paper. I'm
12:28:39 talking about a letter from...
12:28:44 **A.** Well this -- the metadata contained here
12:28:47 reflects the reception and acceptance dates, so --
12:28:52 **Q.** Well which one's correct, sir?
12:28:55 **A.** I think they're both correct.
12:28:56 **Q.** So the transcript was received both on -- or
12:29:00 the manuscript was received both on June 16th, 2017,
12:29:04 and May 4th, 2017?
12:29:06 MR. GOSS: Object to form.
12:29:08 **A.** I think there's some confusion. When a
12:29:11 document is sent in, that's the reception date. So as
12:29:15 I look at this that would have been April 24th.
12:29:19 Now according to this paper it was received
12:29:24 by the editor-in-chief on May 4th. So those aren't
12:29:33 discongruent facts, those are coherent facts. It goes
12:29:35 to the journal and then it goes to the
12:29:37 editor-in-chief.
12:29:37 **Q.** What evidence do you have that you submitted
12:29:39 your paper on April -- April 24th, 2017? Besides

12:29:45 Exhibit Number 3.
12:29:45 **A.** I don't. I could look at the creation file
12:29:50 that I sent, but I don't know -- sitting here right
12:29:55 now, I don't have that.
12:29:57 **Q.** You agree with me that between May 4th, 2017
12:30:02 and May 31st, 2017 there's only approximately 19
12:30:07 business days?
12:30:14 **A.** Say -- could you say that -- ask that again?
12:30:15 **Q.** Between May 4th, 2017 and May 31st 2017
12:30:19 there's only approximately 19 business days.
12:30:22 **A.** I would agree.
12:30:41 (Abraham Exhibit 8 marked for
12:30:41 identification.)
12:30:41 BY MR. ASSAAD:
12:30:54 **Q.** What is Exhibit 8?
12:30:56 **A.** Exhibit 8 is a cover letter.
12:31:00 **Q.** Is there a date on this cover letter?
12:31:01 **A.** There is not a date.
12:31:03 **Q.** Is this the cover letter that was attached
12:31:06 to your manuscript that you submitted to*Numerical*
12:31:12 *Heat Transfer*?
12:31:13 **A.** Yes.
12:31:15 **Q.** If I want to find the date of this cover
12:31:16 letter, how would I find it?
12:31:19 **A.** Perhaps going to the metadata of the file.

12:31:23 **Q.** Do you still have that file?
12:31:24 **A.** I believe I do.
12:31:42 **Q.** You agree with me, because of your
12:31:44 relationship with Dr. Minkowiycz, that there'd be a
12:31:48 conflict of interest for him to peer review your
12:31:50 article.
12:31:50 **A.** I disagree.
12:32:13 **Q.** Do you know whether or not the publisher,
12:32:16 Taylor & Francis, would consider that a conflict of
12:32:19 interest?
12:32:20 **A.** I don't believe they would.
12:32:21 **Q.** Now you agree with me that there's nowhere
12:32:29 in the acceptan -- in this letter of Exhibit 7 in
12:32:38 which there's any indication that this article was
12:32:45 peer reviewed.
12:32:48 **A.** Which exhibit?
12:32:50 **Q.** Seven.
12:32:51 MR. GOSS: Seven.
12:32:55 **A.** I disagree.
12:32:56 **Q.** Where does it say it was peer reviewed?
12:32:58 **A.** In the first paragraph.
12:32:59 **Q.** It says, "I have reviewed the paper" -- and
12:33:01 "I," would you agree with me, would be Dr. Minkowycz?
12:33:05 **A.** Yes.
12:33:06 **Q.** It says, "I have reviewed the paper

12:33:07 carefully and find it to be of good quality." Is that
12:33:09 what it states?
12:33:10 **A.** Yes, it does.
12:33:11 **Q.** "Indeed, the quality standard of the paper
12:33:13 merits its acceptance for publication without further
12:33:16 review."
12:33:16 Did I read that correctly?
12:33:17 **A.** Yes, you did.
12:33:18 **Q.** So as of May 31st, 2017 there is no
12:33:24 indication in this letter that this paper has been
12:33:28 reviewed by any peer reviewers; correct?
12:33:30 MR. GOSS: Object to form.
12:33:31 **A.** Incorrect.
12:33:32 **Q.** Where does it --
12:33:33 Where is the term "peer" or "referee" or
12:33:37 "reviewer" in this -- in Exhibit 7?
12:33:41 **A.** It's the word "I." Editors-in-chief have
12:33:44 the prerogative to review papers. In fact I am an
12:33:48 editor on many publications and I routinely do the
12:33:51 review myself.
12:33:52 **Q.** So it's your opinion that the re -- the peer
12:33:55 review was done by Dr. Minkowiycz?
12:33:57 **A.** According to this letter he says "I have
12:33:59 reviewed." Now it may have gone out to other people
12:34:03 as well, maybe he accepted it before he got reviews

back. Maybe it didn't go out to anyone, maybe he did the review. But that's the prerogative and the practice of editors-in-chief.

Q. Okay. So it's your understanding --

Well you agree with me that at this point in time, today, the only person that we're aware of that reviewed your publication, Exhibit Number 3, is Dr. Minkowiycz.

MR. GOSS: Before it was published.

Q. Before it was published.

A. Correct.

Q. Okay. You agree with me that there's no indication in Exhibit 7 that your publication was reviewed by anyone other than Dr. Minkowiycz.

MR. GOSS: Before it was published.

Q. Before it was published.

A. I agree.

Q. And*Numerical Heat Transfer* is a journal that does not rely on post-publication review; correct?

A. I don't know that.

Q. Okay. So it's your opinion that as long as Dr. Minkowiycz reviewed your paper that would make this paper a peer-reviewed paper according to the guidelines of the*Numerical Heat Transfer* journal.

A. I don't know the guidelines of the*Numerical Heat Transfer* journal, but what I'll tell you is the practice is editors-in-chief have the prerogative to do reviews.

Q. I'm not asking about in general. I'm talking about what is required by*Numerical Heat Transfer*. Do you know one way or the other?

A. I do not know.

Q. Okay. Would you be surprised that editors-in-chief are not allowed to publish papers without them being peer reviewed in*Numerical Heat Transfer*?

A. I don't know one way or the other.

Q. And I think I asked you this before, but you know what a double-blind peer review is; correct?

A. Yes, I do.

Q. It's where the author and the reviewers do not know who each other are.

A. That is correct.

(Abraham Exhibit 9 marked for identification.)

BY MR. ASSAAD:

Q. Exhibit 9 is the "Instructions for authors" for*Numerical Heat Transfer, Part A: Applications*. Do you agree with that?

A. Yes.

Q. Have you seen this document before?

A. No.

Q. And I represent to you that I have taken this off the Taylor & Francis website on -- yesterday, or -- yes, yesterday, Valentine's Day, February 14th, 2018.

Do you see where it says "Peer review"?

A. Yes.

Q. It states: "Taylor & Francis is committed to peer-review integrity and upholding the highest standards of review. Once your paper has been assessed for suitability by the editor, it will then be double blind peer-reviewed by expert referees."

Did I read that correctly?

A. Yes.

Q. You understand what it means to be assessed for suitability by the editor?

A. Yes.

Q. That means --

You agree with me that means that the paper, the subject matter of the paper is the type of scientific areas that this paper -- that the journal usually publishes.

A. That is typically the meaning.

Q. So according to this document, you agree with me that*Numerical Heat Transfer, Part A: Applications* con -- the peer-review process consists of a double-blind peer-review process.

A. That's what this document states.

Q. And it's your opinion -- Strike that.

Did you have any conversations with Dr. Minkowiycz, email, phone, with respect to this paper?

A. Yes.

Q. When?

A. It would have been before it was submitted.

Q. And do you have email correspondence with him?

A. No.

Q. It was a phone conversation?

A. Yes.

Q. How many?

A. One.

Q. Tell me about it.

A. I asked him which --

I told him that I was preparing a calculation of airflow, and I wanted to know what journal he thought it would be best suited for.

Q. Did you tell him that you were a litigation consultant with respect to the -- and that was the

12:39:31 reason why you got the research to do this CFD
12:39:35 calculation?
12:39:37 MR. GOSS: Object to form.
12:39:39 **A.** I think you're conflating the study, the
12:39:43 grant study and the litigation consultancy. I was
12:39:47 hired by 3M to do an academic study, and that work was
12:39:52 published and the funding was disclosed. So I told
12:39:55 him that. I did not mention anything of a litigation.
12:40:52 **Q.** And it's your opinion that there's no
12:40:59 conflict of interest for Dr. Minkowiycz to review your
12:41:03 paper?
12:41:04 **A.** Yes, because we have no conflicts. We have
12:41:07 no financial relationship at all. The fact I have
12:41:13 published with him can't be considered a conflict
12:41:15 because I publish with almost everyone. And I publish
12:41:18 with many editors, many editors-in-chief. The fact
12:41:22 is, I wanted this to go to the top journal, a journal
12:41:26 that was best suited for the study, and he happens to
12:41:28 be the editor-in-chief there. I didn't prejudice my
12:41:32 study in any way by telling him that it was involved
12:41:36 in a litigation, but I did disclose funding from 3M
12:41:40 for the academic part of the work.
12:41:42 **Q.** So the answer to my question is you don't
12:41:44 believe it's a conflict of interest for Dr. Minkowiycz
12:41:46 to review your paper.

12:41:47 **A.** I do not.
12:41:48 **Q.** Okay.
12:41:50 (Abraham Exhibit 10 marked for
12:41:50 identification.)
12:41:50 BY MR. ASSAAD:
12:42:10 **Q.** Exhibit Number 10 is another article from
12:42:14 Taylor & Francis, who's the publisher of*Numerical*
12:42:18 *Heat Transfer*, Applications A, titled "Ethical
12:42:21 considerations when assigning independent reviewers."
12:42:24 Under "Reviewer bias and conflicts of
12:42:28 interest" it states: "To ensure a fair review is
12:42:31 carried out, potential reviewers should be reviewed to
12:42:34 identify the possibility of any conflicts of interest
12:42:38 which may lead to bias. For example, a reviewer's
12:42:43 author history and institution should be observed to
12:42:46 discover whether they have been a recent collaborator
12:42:50 with, or worked at the same organization as, the
12:42:53 author."
12:42:54 You would agree with me that you and Dr.
12:42:58 Minkowiycz have been collaborators in articles over
12:43:02 the past three years.
12:43:03 **A.** I would agree to that statement.
12:43:05 **Q.** "Preferably, the reviewer should not have
12:43:08 worked with the author in the last three years."
12:43:11 Did I read that correctly?

12:43:12 **A.** Yes.
12:43:13 **Q.** You have worked with Dr. Minkowiycz in the
12:43:14 last three years; correct?
12:43:16 **A.** Correct.
12:43:21 **Q.** "However, if they have recently collaborated
12:43:23 with the author or share the same affiliation, this
12:43:27 may constitute a potential conflict of interest, and
12:43:30 subsequently result in a biased review."
12:43:32 Did I read that correctly?
12:43:32 **A.** You read that correctly.
12:43:55 MR. ASSAAD: Let's go to lunch.
12:43:58 THE REPORTER: Off the record, please.
12:44:00 (Luncheon recess taken at
approximately 12:44 p.m.)

AFTERNOON SESSION
(Deposition reconvened at
approximately 1:32 p.m.)
BY MR. ASSAAD:
13:32:53 **Q.** Just so the jury would understand, how do
13:32:56 you define "divergence"?
13:33:07 **A.** Divergence is often when your results reach
13:33:15 unrealistic magnitudes, or change in ways that are
13:33:20 unphysical.
13:33:25 **Q.** And how would you define "convergence"?
13:33:29 **A.** When your results give the -- essentially
13:33:33 the same results, when they converge to a single
13:33:37 answer.
13:34:09 **Q.** Now in your report in this case on the 505
13:34:12 you used ANSYS; correct?
13:34:14 **A.** Correct.
13:34:15 **Q.** Okay. Do you recall what version?
13:34:20 **A.** I think it was 17.1.
13:34:22 **Q.** Okay. And you used a Large-Eddy Simulation;
13:34:26 correct?
13:34:27 **A.** Correct.
13:34:28 **Q.** Okay. And what equations do the Large-Eddy
13:34:34 Simulation utilize?
13:34:36 **A.** They utilize what's called the Navier-Stokes
13:34:40 equations.

13:34:43 **Q.** And is there a certain form of the
13:34:46 Navier-Stokes equations that they use?
13:34:48 **A.** No.
13:34:50 **Q.** So it's your understanding that LES uses
13:34:53 Navier-Stokes equations.
13:34:54 **A.** Yes.
13:34:55 **Q.** Okay. Is that the equations that were used
13:35:10 in the 505 analysis?
13:35:12 **A.** Yes.
13:35:20 **Q.** Now I'm looking at your --
13:35:24 Can you go to your report, Exhibit Number --
13:35:28 your Gareis report. You agree with me that in the
13:35:34 Gareis report there are no identification of any
13:35:37 equations; correct?
13:35:43 **A.** I disagree.
13:35:46 **Q.** Okay. Where are the --
13:35:47 Where are the Navier-Stokes equations in the
13:35:49 Gareis report?
13:35:54 **A.** I think you changed up that question. In
13:35:57 the Gareis report I specify what set of equations I
13:36:01 used in the paragraph that precedes section 3 on page
13:36:05 3. "It was decided to use the Large-Eddy Simulation
13:36:11 (LES) method..." And then I go on to talk about
13:36:16 buoyancy and eddy formation, but that is the
13:36:19 indication of which equations were used. Later in

13:36:21 that same paragraph it's written: "The unsteady
13:36:26 Navier-Stokes equations are filtered so that eddies
13:36:30 whose scales are smaller than the mesh...," and I
13:36:33 could go on and on, but the point is the LES and the
13:36:36 Navier-Stokes equations are la -- listed here.
13:36:40 **Q.** Could you please write down the filtered
13:36:44 Navier-Stokes equations?
13:36:46 MR. GOSS: Oh, pop quiz time.
13:36:50 **A.** I think I can. This is like a --
13:36:53 Do I have a pen? Could I use a pen?
13:36:53 MR. ASSAAD: Do you have a pen?
13:36:58 [Pen provided to the witness.]
13:36:58 **Q.** And I'm talking about the filtered
13:37:00 Navier-Stokes equations that are utilized in ANSYS.
13:37:04 **A.** It's a long equation, it is written in my
13:37:07 journal paper. I'm going to try to do it from memory.
13:37:23 (Witness writing.)
13:37:57 I think that's it. Without checking a book
13:37:59 or my paper, that's what I recall.
13:38:02 MR. ASSAAD: Let's mark this as Exhibit
13:38:05 Number 11.
13:38:16 (Abraham Exhibit 11 marked for
13:38:16 identification.)
13:38:16 BY MR. ASSAAD:
13:38:19 **Q.** And can you please describe what each of the

13:38:21 terms are, each of the -- each of the terms.
13:38:26 **A.** Yes, I can.
13:38:30 The first term in this equation is what's
13:38:33 called the inertial term. Rho is the density of the
13:38:37 fluid. U -- this -- this symbol, it looks like a --
13:38:43 almost like a 2, it refers to a partial derivative,
13:38:48 and you see that same term down here [indicating].
13:38:51 Now down below there's a "T," that stands for time,
13:38:55 and up here there's a "U," and that stands for
13:38:58 velocity. There is a subscript "i" here and that
13:39:02 refers to what's called tensor notation, and it's just
13:39:07 a way of making your results more compact, so you --
13:39:10 In actuality there's equations in all three
13:39:13 directions, the X, Y, Z direction, and we just use "U"
13:39:17 to represent the fact that there's --
13:39:19 **Q.** So the first is the inertia term; correct?
13:39:21 **A.** Correct.
13:39:21 **Q.** What's the second one, the second section?
13:39:24 **A.** The second term, and there's a rho here,
13:39:27 again that's the density. There's a "U" again, and
13:39:31 that's the same as the "U" that appears here. And
13:39:34 then there's this -- again this funny 2 above and
13:39:38 below, and this is a -- it's really a derivative of
13:39:41 velocity with respect to position. So this is a --
13:39:44 what's called a velocity gradient.

13:39:46 **Q.** Okay.
13:39:46 **A.** This term is a momentum term of the flowing
13:39:50 fluid.
13:39:50 **Q.** So you have the inertia and the momentum;
13:39:52 correct?
13:39:53 **A.** Correct.
13:39:53 **Q.** And what's on the other side of the equal
13:39:55 sign?
13:39:56 **A.** On the other side of the equal sign there is
13:39:58 a derivative of pressure, so "P" stands for pressure,
13:40:04 "X" again stands for position, so this is a pressure
13:40:08 gradient term.
13:40:10 **Q.** Okay. And what's the next term?
13:40:13 **A.** The next term relates to viscosity. So mu
13:40:16 is the viscosity of the fluid, and here we have a
13:40:20 second derivative of velocity with respect to
13:40:25 position. So you can think of it as a gradient of a
13:40:27 gradient, and it really is a friction term.
13:40:30 **Q.** Now that's different than the Navier-Stokes
13:40:34 equations because it's filtered; correct?
13:40:41 **A.** Well the filtering --
13:40:43 Well no. This -- This is the Navier-Stokes
13:40:45 equation.
13:40:45 **Q.** What's the filtered Navier-Stokes equation?
13:40:45 **A.** So there's a --

13:40:49 **Q.** Can you write down that equation?
13:40:51 MR. GOSS: Let him answer the first
13:40:52 question.
13:40:53 MR. ASSAAD: I withdraw that question.
13:40:54 **Q.** Can you write down the filtered
13:40:58 Navier-Stokes equation?
13:40:59 **A.** Yes.
13:41:00 **Q.** Go ahead.
13:41:00 **A.** The filtering occurs right here
13:41:04 [indicating]. It occurs in this tau term. So the
13:41:07 issue of filtering is this. Some -- This is applied
13:41:12 to different size scales, and you have to remember
13:41:16 we're solving this equation at all of the elements,
13:41:20 all of the mesh elements. And there are frictional
13:41:24 terms, there's -- there's shear terms that are not
13:41:27 captured just by this, but are related to turbulence,
13:41:33 and they appear here.
13:41:35 Now some of that turbulence structure is
13:41:39 bigger than our elements, and for those turbulence
13:41:42 structures we're going to capture it directly, but
13:41:44 some of the -- some of the motion's smaller than an
13:41:47 element, and for those we have to do what's called
13:41:50 modeling, and we use what's called a sub-grid scale
13:41:53 model to account for small turbulent structures that
13:41:56 are smaller than an element, and that's the filtering

13:42:00 process.
13:42:00 **Q.** And in ANSYS you use WALE; correct?
13:42:04 **A.** I use the LES WALE method.
13:42:07 **Q.** Okay. Can you please write down those
13:42:09 equations?
13:42:09 **A.** No.
13:42:10 **Q.** You can't do that?
13:42:11 **A.** I cannot write those from memory. I
13:42:11 didn't --
13:42:12 **Q.** Okay.
13:42:13 **A.** -- realize this was a memory test. I cannot
13:42:15 write them from memory.
13:42:16 **Q.** Okay. So --
13:42:17 But you have worked with ANSYS on numerous
13:42:19 times; correct?
13:42:20 **A.** That is correct.
13:42:20 **Q.** And you've done --
13:42:22 And I think you mentioned before that you've
13:42:23 actually done coding for ANSYS; correct? You've
13:42:28 written some code for them?
13:42:30 **A.** I have modified the ANSYS code.
13:42:32 **Q.** Okay.
13:42:33 **A.** I don't know if I've written code that they
13:42:34 have imported into their software.
13:42:38 **Q.** And you understand that the sub-grid --

13:42:40 sub-grid scale used by ANSYS is LES WALE; correct?
13:42:45 **A.** That is one of the options. That's the
13:42:46 option I used.
13:42:47 **Q.** Okay. And that itself has equations to
13:42:51 model the sub-grid scale; correct?
13:42:52 **A.** That is correct.
13:42:53 **Q.** And sitting here today, you can't write down
13:42:55 the equations for the sub-grid scale that you used.
13:42:57 **A.** With --
13:42:57 MR. GOSS: Asked and answered.
13:42:59 **Q.** Correct?
13:43:00 **A.** Without a reference I cannot write them from
13:43:02 memory.
13:43:10 **Q.** Are you able to write down the equations for
13:43:14 the Boussinesq approximation?
13:43:19 **A.** I think I could write that down.
13:43:20 **Q.** Please do, on that same piece of paper.
13:43:23 **A.** (Witness complying.)
13:44:57 From memory I think it is this.
13:44:59 **Q.** By the way, can you label each of the
13:45:01 equations, of what they are?
13:45:03 **A.** Certainly. (Witness complying.)
13:45:27 **Q.** And the options in ANSYS, you either can use
13:45:31 Boussinesq or Ideal; correct? Ideal Gas.
13:45:34 **A.** Those are two options.

13:45:36 **Q.** Okay. I'm going to backtrack a little bit.
13:45:42 (Abraham Exhibit 12 marked for
13:45:52 identification.)
13:45:52 (Discussion off the stenographic record.)
13:45:52 BY MR. ASSAAD:
13:45:52 **Q.** I just have a quick question. This is an
13:45:55 email on June 1st, 2017 from Dr. Minkowycz to
13:46:01 yourself. Do you see that?
13:46:02 **A.** Yes.
13:46:02 **Q.** And you produced this in response to our
13:46:03 subpoena; correct?
13:46:04 **A.** Yes.
13:46:06 **Q.** What's the attachment?
13:46:08 **A.** I don't know what the attachment is. It may
13:46:10 be this letter that he sent me. I think it's that
13:46:14 letter, but I don't know.
13:46:16 MR. GOSS: I'll represent to you that it is
13:46:19 the acceptance letter.
13:46:20 MR. ASSAAD: Okay.
13:46:21 **Q.** So the acceptance letter was emailed to you
13:46:23 on June 1st, 2017; correct?
13:46:26 **A.** That's what this says.
13:46:27 **Q.** Okay. Now going back to the 505 model --
13:46:43 Strike that.
13:46:44 MR. ASSAAD: And you're talking about the

13:46:45 acceptance letter that was produced to us last week;
13:46:47 correct?
13:46:49 MR. GOSS: It's -- Did you already mark it
13:46:52 as an exhibit?
13:46:53 MR. ASSAAD: But it was produced last week
13:46:55 to us; correct?
13:46:56 MR. GOSS: It's Exhibit -- It's 7.
13:46:58 MR. ASSAAD: I understand, but it was
13:46:59 produced to us last week.
13:47:03 MR. GOSS: Sure. I'm not under oath, but I
13:47:08 will stand by that.
13:47:13 BY MR. ASSAAD:
13:47:16 **Q.** With regard to the communications you had
13:47:17 with*Numerical Heat Transfer* journal, these
13:47:23 communications were prior to your deposition in July;
13:47:30 correct?
13:47:31 **A.** Correct.
13:47:31 **Q.** And you did not produce those to us in
13:47:34 responsive to our subpoena back then; correct?
13:47:36 MR. GOSS: I'll just state an objection
13:47:37 that Dr. Elghobashi had refused to produce any
13:47:42 journal correspondence under the Ingelfinger rule, we
13:47:45 responded in kind.
13:47:50 MR. ASSAAD: Is there a legal objection?
13:47:53 MR. GOSS: It's an explanation. It's an

13:47:55 explanation.
13:47:57 BY MR. ASSAAD:
13:47:58 **Q.** So you did not produce --
13:47:59 When did you produce these documents, like
13:48:02 Exhibits Number 12, as well as the acceptance letter,
13:48:04 to your attorneys?
13:48:06 **A.** I don't recall.
13:48:08 **Q.** Was it in responsive to the subpoena that
13:48:10 was issued to you in January of this year, or a
13:48:12 previous subpoena?
13:48:13 **A.** I don't recall.
13:48:31 **Q.** Do you keep a correspondence file with
13:48:33 respect to what you send over to your attorneys, or
13:48:38 3M?
13:48:39 **A.** I don't send anything to 3M. I don't recall
13:48:41 sending anything to 3M.
13:48:42 **Q.** Or their attorneys?
13:48:45 **A.** What is a correspondence file?
13:48:46 **Q.** Do you keep track of what documents you send
13:48:50 back and forth between you and counsel for 3M?
13:48:53 **A.** I do not.
13:49:21 **Q.** When you ran your CFD for the 505 were there
13:49:32 any errors that occurred with respect to the CFD?
13:49:39 **A.** Can you define "error"?
13:49:41 **Q.** Were any error --

13:49:42 Was there any error notices by ANSYS with
13:49:45 respect to how you were doing the CFD?
13:49:47 **A.** I don't recall.
13:49:50 **Q.** If there is an error -- If there is an error
13:49:59 -- Strike that.
13:49:59 When you run ANSYS and if you're doing
13:50:02 something incorrectly or against ANSYS' best
13:50:09 practices, it'll indicate it to you by an error
13:50:11 message; correct?
13:50:13 **A.** It may, but sometimes it'll tell you if
13:50:17 you're doing something that's advanced and they'll
13:50:20 give you a warning saying you're doing something
13:50:22 that's advanced, only people with advanced knowledge
13:50:25 should be doing this. So they give -- sometimes
13:50:27 they'll give you a warning that general practice is to
13:50:33 do it a different way. So there -- there are all
13:50:35 sorts of different warnings that you may get.
13:50:37 **Q.** Did you get any in this case with the 505?
13:50:39 **A.** I don't recall.
13:50:40 **Q.** Did you look?
13:50:42 **A.** I would have noticed them if I got one.
13:50:55 **Q.** For example, if you used -- ANSYS might give
13:50:58 you a warning if you used the wrong subscale --
13:51:02 sub-grid scale.
13:51:05 **A.** I don't think that's quite right. I mean,

13:51:09 there are choices that you make, and ANSYS may
13:51:13 recommend a different choice and it may not. But to
13:51:17 say that one is right or wrong, I -- I don't think I
13:51:20 would agree with that.
13:51:20 **Q.** Well does it give you a recommendation or
13:51:22 does it give an error message?
13:51:24 **A.** I don't know the answer to that.
13:51:25 **Q.** Have you ever received an error message in
13:51:27 any of the work you did on ANSYS?
13:51:29 **A.** I almost always receive error messages.
13:51:32 **Q.** And what do you do in those situations?
13:51:34 **A.** I evaluate the error message and decide if
13:51:36 action is needed -- needs to be taken.
13:51:52 **Q.** Now in your 505 you looked at the 505
13:51:59 Service Manual to determine the volumetric flow rate
13:52:04 for the Bair Hugger unit; correct?
13:52:29 **A.** That is incorrect.
13:52:46 **Q.** Did you look at the Operator's Manual?
13:52:47 **A.** That is correct.
13:52:48 **Q.** So you looked at the Operators Manual to
13:52:49 determine the flow rate; correct? Or the volumetric
13:52:52 flow rate.
13:52:53 **A.** Yes.
13:52:54 **Q.** And you obtained -- you used the number 28
13:52:58 cubic feet per minute; correct?

13:53:00 **A.** That is correct.
13:53:01 **Q.** Okay. And according to the Operator's
13:53:03 Manual, it actually gives 28 to 30 cubic feet per
13:53:06 minute; correct?
13:53:07 **A.** That is correct.
13:53:12 **Q.** And you yourself relied on the 505
13:53:14 Operator's Manual to obtain the volumetric flow rate.
13:53:20 **A.** I actually don't recall if I relied on it,
13:53:25 or if I had an idea of the flow rate and I just
13:53:28 checked it to see if it was consistent with the
13:53:30 Operator's Manual. I don't recall. But in the end,
13:53:35 the 28 is consistent with the Operator's Manual.
13:53:38 **Q.** Okay.
13:53:40 **A.** But I don't recall which -- whether I relied
13:53:42 on -- primarily on my memory or the Operator's Manual.
13:53:50 **Q.** What's the volumetric flow rate of --
13:53:52 I mean, you've done work for Smiths Medical,
13:53:58 correct, on their forced-air warming machines;
13:54:00 correct?
13:54:00 **A.** That is correct.
13:54:01 **Q.** What's the volumetric flow rate for the
13:54:03 Smiths Medical device?
13:54:04 **A.** They have many devices.
13:54:06 **Q.** Well what's the device you worked on?
13:54:07 **A.** I worked on multiple devices.

13:54:09 **Q.** Can you give me one?
13:54:10 **A.** I can give you the --
13:54:11 They were named with letters and numbers,
13:54:16 they were EQ something, I don't remember the number.
13:54:22 The devices that I worked on formed the basis of the
13:54:26 journal publication that I did in I think 2016 on
13:54:31 patient-warming devices, but I don't remember the
13:54:32 model numbers of the blankets. I remember there being
13:54:35 multiple blankets.
13:54:36 **Q.** What about the blower; do you remember the
13:54:39 volumetric flow rate of the blower?
13:54:41 **A.** I worked on multiple blowers.
13:54:43 **Q.** Any one of them.
13:54:45 **A.** I would have to refer to my records for that
13:54:49 study.
13:54:51 **Q.** How --
13:54:51 I mean, if you did not use the Operator's
13:54:53 Manual to determine the flow rate being 28 with the
13:54:57 505, what are you relying upon?
13:55:05 **A.** And I'm going to ask a question.
13:55:08 THE WITNESS: This is a proprietary --
13:55:13 MR. ASSAAD: If he's relying on something,
13:55:14 it's -- we have a confiden --
13:55:16 **A.** I'll tell you -- I'll tell you -- I --
13:55:18 MR. GOSS: If it's proprietary we would

13:55:20 designate it as Confidential under the Protective
13:55:22 Order. If you're relying on something, you can
13:55:24 answer his question.
13:55:27 **A.** I ran a --
13:55:28 I was hired by Smiths to evaluate their
13:55:31 blankets and blowers and their competitor's, and in
13:55:35 that evaluation we tested multiple Smiths Medical
13:55:41 blankets and blowers and multiple 3M blankets and
13:55:44 blowers, and I think other manufacturers as well. So
13:55:47 I have a whole set of data from those experiments, and
13:55:54 what I recall was flow rates in the range of 28.
13:55:59 **Q.** Okay. For the Smiths Medical or for the
13:56:03 505?
13:56:04 **A.** For upper body blankets with lower blowers,
13:56:09 lower blowers. So both -- all companies had a high
13:56:14 blow -- high blower case and they've got different
13:56:16 blower settings, and a lower blower case.
13:56:20 And just to put on the record, the reason
13:56:22 why I struggled with the proprietary nature is Smiths
13:56:25 does not want oth -- their competitors to know I
13:56:28 tested their blankets.
13:56:38 **Q.** There's no indication in your report which
13:56:41 has been marked as Exhibit Number 1, that you -- when
13:56:52 you tested the -- when you did the 505 CFD that you
13:56:57 had the Bair Hugger -- you ran it with the Bair Hugger

13:57:00 off; correct?
13:57:01 **A.** That is correct.
13:57:02 **Q.** Going back to Smiths Medical, you understand
13:57:04 that Smiths Medical and 3M are competitors.
13:57:06 **A.** I understand that.
13:57:09 **Q.** In the field of patient warming.
13:57:11 **A.** That's what I understand.
13:57:16 **Q.** When you were retained by 3M to do research,
13:57:20 did you inform Smiths Medical that you were -- been
13:57:25 asked by 3M to do research on their blowers?
13:57:27 **A.** Yes.
13:57:29 **Q.** Who'd you speak with at Smiths Medical?
13:57:32 **A.** I don't recall.
13:57:36 **Q.** Was there a conflict of interest for you
13:57:38 doing work with Smiths Medical and 3M?
13:57:41 **A.** Not --
13:57:41 I do not believe there is.
13:57:43 **Q.** Did you ask for any sort of waiver regarding
13:57:46 any conflict?
13:57:47 **A.** I don't --
13:57:48 MR. GOSS: Object to form.
13:57:49 **A.** I don't recall asking for a waiver.
13:58:04 **Q.** Now I'm going to get into your report real
13:58:07 quick, but just -- I know I've asked you this before.
13:58:09 I just want to be sure we're on the same page.

13:58:11 The only thing that changes between the 750
13:58:16 and the 505 CFD analysis is the volumetric flow out of
13:58:22 the Bair Hugger.
13:58:23 **A.** That is all that I recall changing.
13:58:25 **Q.** You used the same equations; correct?
13:58:27 **A.** Correct.
13:58:44 **Q.** You used 41 degrees Celsius; correct?
13:58:46 **A.** Correct.
13:58:47 **Q.** And that was higher than what Dr. Elghobashi
13:58:49 used in his 505 analysis; correct?
13:58:54 **A.** I don't recall what he used.
13:58:56 **Q.** If he used 40.5 degrees, you would agree
13:58:58 with me that 41 degrees is higher than 40.5.
13:59:01 **A.** I agree.
13:59:02 **Q.** Okay. Your air inlet temperature was 15
13:59:05 degrees Celsius; correct? From the ceiling.
13:59:11 **A.** Correct.
13:59:12 **Q.** And do you agree with me that that's the
13:59:15 same temperature that Dr. Elghobashi used in his CFD
13:59:17 analysis?
13:59:18 **A.** I -- I agree.
13:59:21 **Q.** You had four exhaust vents in your CFD
13:59:24 analysis; correct?
13:59:25 **A.** Correct.
13:59:25 **Q.** That's the same as Dr. Elghobashi used in

13:59:27 his CFD analysis; correct?
13:59:29 **A.** Correct.
13:59:35 **Q.** Your room sizes were very similar, but not
13:59:38 exact between you and Dr. Elghobashi; correct?
13:59:40 **A.** Correct.
13:59:41 **Q.** You used an exchange -- air -- air changes
13:59:46 per hour of 27.69 in your CFD analysis; correct?
13:59:53 **A.** Well it states here an air change every 130
13:59:56 seconds. I could convert that to hours. But my
13:59:59 report says one air change every 130 seconds.
14:00:08 **Q.** And to calculate the air-exchange rate you
14:00:11 would divide -- you'd take 3600 and divide it by 130;
14:00:15 correct?
14:00:15 **A.** Yes.
14:00:19 **Q.** I represent to you that that number is
14:00:22 27.692. So would you agree with me that the air
14:00:25 change rate per hour is 27.69 in your CFD analysis?
14:00:29 **A.** Yes, I would.
14:00:30 **Q.** Now you say, approximately every 130
14:00:33 seconds; correct?
14:00:36 Do you know what the --
14:00:37 **A.** Incorrect.
14:00:42 **Q.** So you had an air exchange every 130
14:00:44 seconds?
14:00:46 **A.** That's what this statement says. It says,

14:00:48 "The volume of the room is 5190 cubic feet...so that
14:00:54 the ventilation flow resulted in one air change every
14:00:57 130 seconds."
14:00:58 **Q.** So that's an exact number; correct?
14:01:02 **A.** Well it's exact to the two significant
14:01:05 figures. It may be 130.2, it might be 129.8, but I'm
14:01:11 not claiming that level of accuracy.
14:01:13 **Q.** And you would agree with me that with
14:01:15 respect to the operating -- or the surgical table, you
14:01:20 used the same height as Dr. Elghobashi.
14:01:23 **A.** I don't know that.
14:01:25 **Q.** But it was very similar to height and shape;
14:01:27 correct?
14:01:28 **A.** I don't know...
14:01:29 I don't recall what his height was.
14:01:31 **Q.** Okay. Now you agree with me -- Strike that.
14:01:49 On page 1 in your report of Exhibit 1,
14:01:56 second paragraph, you state: "Note that the assumed
14:02:01 temperature of 41 degrees Celsius at the blanket
14:02:04 outlet is significantly higher than temperatures
14:02:07 measured in experimental settings...for example, T.
14:02:12 Kuehn General Causation report Exhibit C."
14:02:15 Did I read that correctly?
14:02:16 **A.** Yes.
14:02:16 **Q.** Are you referring to any other experimental

14:02:18 settings besides Dr. Kuehn's general causation report?
14:02:25 **A.** No.
14:02:28 **Q.** Are you relying in any way with re -- to Dr.
14:02:31 Kuehn's general causation report to offer any opinions
14:02:35 with respect to the exit temperature of the Bair
14:02:39 Hugger as the air -- as the Bair Hugger -- of the Bair
14:02:41 Hugger air as it leaves the perforations from the
14:02:44 blanket?
14:02:44 MR. GOSS: In his model, or otherwise?
14:02:47 MR. ASSAAD: Otherwise.
14:02:49 **A.** Could you read back that?
14:02:50 **Q.** I'll rephrase it.
14:02:52 **A.** Yeah.
14:02:53 **Q.** You're saying that 41 degrees Celsius is
14:02:55 significantly higher than the temperatures measured in
14:02:58 experimental settings, and you rely on Dr. Kuehn's
14:03:02 report; correct?
14:03:04 **A.** No. I think you've misinterpreted that.
14:03:07 The key sentence is the next sentence. "Again, my
14:03:11 intent was to model a worst-case scenario to
14:03:14 exaggerate the effect" of Bair Hugger -- "of the Bair
14:03:16 Hugger on the operating room airflow."
14:03:18 So what I'm saying here is I'm acknowledging
14:03:21 that 41 Celsius is artificially high. I'm choosing it
14:03:26 because it's a worst-case scenario.

14:03:28 **Q.** Okay. My question is: Are you saying it's
14:03:30 artificially high because of the experimental data
14:03:33 from Dr. Kuehn?
14:03:34 **A.** No.
14:03:35 **Q.** Okay. So why are you putting in here Dr.
14:03:38 Kuehn's general report, Exhibit C?
14:03:41 **A.** Because that's an example of someone who has
14:03:43 made measurements that are lower.
14:03:46 **Q.** Have you read his deposition, Dr. Kuehn's
14:03:49 deposition?
14:03:49 **A.** I have read his deposition.
14:03:54 **Q.** What other data are you relying upon with
14:03:58 respect to the actual temperature of the exit air
14:04:00 coming from the Bair Hugger?
14:04:02 **A.** My own experimental data.
14:04:04 **Q.** Where is that?
14:04:05 **A.** I ran experiments in per --
14:04:08 **Q.** I didn't say what. I said where?
14:04:10 **A.** Oh, I don't have that data.
14:04:11 **Q.** Okay. And since you don't have that data,
14:04:26 that data was never produced to us; correct? In this
14:04:29 case.
14:04:29 **A.** That is correct.
14:05:06 **Q.** What is the difference between using the
14:05:09 Boussinesq approximation and Ideal Gas law in ANSYS?

14:05:16 **A.** The difference is how the density is
14:05:20 calculated, and in particular how changes in density
14:05:23 are calculated. The Boussinesq relates density
14:05:26 changes to temperature differences, and the Ideal Gas
14:05:30 law calculates density changes using the Ideal Gas
14:05:35 law.
14:05:35 **Q.** Which one's more accurate?
14:05:39 **A.** It --
14:05:40 MR. GOSS: I feel like we went over this in
14:05:42 the last deposition, but you can answer the question.
14:05:44 **A.** I did answer this in the last deposition,
14:05:47 and my answer is the same, and that is this: The
14:05:50 Boussinesq model is going to overestimate any effect
14:05:55 that the Bair Hugger might have. So again I'm
14:05:58 choosing a worst-case scenario to stack the cards
14:06:03 against the Bair Hugger to see if I can get intrusion
14:06:06 of air to the surgical site.
14:06:08 **Q.** Okay. With respect to the images that were
14:06:42 -- Withdraw.
14:06:42 The mesh that you used in the 505 results in
14:06:46 your report of Exhibit 1, is that the
14:06:50 nine-million-cell mesh that was used in the 750?
14:06:53 **A.** That is my recollection.
14:07:18 **Q.** Why did you run the 505 model longer than
14:07:24 the 750 model and simulation time?

14:07:32 **A.** I don't know the answer to that. It may be
14:07:34 that I used --
14:07:35 **Q.** If you don't -- If you don't know the
14:07:36 answer, I don't want any guessing, so that's fine.
14:07:39 Did you use the same computer for both the
14:07:43 505 and the 750?
14:07:44 **A.** Yes.
14:07:45 **Q.** Is that the computer that was given to you
14:07:46 by a grant back about five or six years ago?
14:07:50 **A.** I don't know if that computer was given by a
14:07:53 grant. I don't recall.
14:07:56 **Q.** In 2009 you were given 4,200 for the
14:07:59 purchase of a high-performance computer for numerical
14:08:03 simulations. University of St. Thomas Faculty
14:08:06 Development Grant.
14:08:08 **A.** Are you on Exhibit 6?
14:08:10 **Q.** Your CV.
14:08:11 **A.** Okay.
14:08:12 **Q.** Page 5.
14:08:21 **A.** (Witness reviewing exhibit.) I -- No, I
14:08:23 don't -- this computer was not the computer associated
14:08:26 with that grant.
14:08:27 **Q.** Okay. And similar to the 750, you did not
14:08:53 use any type of -- or place any people in your CFD
14:08:58 analysis; correct?

14:09:00 **A.** That is incorrect.
14:09:01 **Q.** You have people in your CFD analysis?
14:09:03 **A.** The patient's there.
14:09:05 **Q.** Oh, okay. Besides the patient there's no
14:09:08 surgical staff or anesthesiology -- anesthesiologist
14:09:10 in your CFD analysis; correct?
14:09:12 **A.** That is correct.
14:09:15 **Q.** And you did not use any size particles in
14:09:17 your CFD analysis; correct?
14:09:20 **A.** That is correct.
14:09:21 **Q.** Okay. Did you alter the mesh in any way
14:09:42 between the 505 and the 750?
14:09:44 **A.** I cannot recall altering the mesh in any
14:09:47 way.
14:09:48 **Q.** So the an --
14:09:49 **A.** I don't believe I did.
14:09:53 **Q.** With respect to the Boussinesq approximation
14:09:57 that was used in the 505, when you use Boussinesq,
14:10:03 what terms does the model change in the Navier-Stokes
14:10:07 equations?
14:10:07 **A.** It changes the buoyancy term.
14:10:09 **Q.** And which one's that in the equation that's
14:10:11 been marked as an exhibit?
14:10:21 **A.** In this exhibit there is a term here which
14:10:25 is the pressure gradient, and inside there is a

buoyancy term. [Exhibit 11.]
Q. So it's the pressure gradient that the Boussinesq is used -- alters in the Navier-Stokes equation.
A. It's the buoyancy term which is contained within the pressure gradient.
Q. Okay. Now you mentioned that you have validated the 750 results; correct?
A. Yes.
Q. By experimentation; correct?
A. Yes.
Q. Did you do the same validation for the 505 results?
A. No.
Q. And your validation in the 750 was two temperature -- temperature taken and smoke tests; correct?
MR. GOSS: Object to form.
A. It was visible water vapor. The primary validation was comparing the flow patterns via visible water vapor in my simulations, and I also compared temperatures.
Q. And actually in your report, your -- in *Numerical Heat Transfer*, Exhibit 3, you actually indicate -- or you superimpose your streamlines and

your water vapor tests; correct?
A. That is correct.
Q. You did not create a graph or a table showing different data with respect to the experimental data compared to the CFD analysis data.
A. You asked about a graph and something else?
Q. Okay. You've done validation before with respect to CFD analysis and experiments; correct?
A. Yes.
Q. And if you look at the validation even that you -- that you reviewed with respect to what Apte and Mahesh have done with respect to the Stanford code, you see a lot of models showing a line graph depicting the experimental data and what the CFD data has obtained.
A. Yes.
Q. And that's commonly done when you're trying to validate a code or -- with respect to experiments; correct?
A. It is sometimes done.
Q. Well you've done that before in the past; correct?
A. Yes, I have.
Q. You've actually done that with Dr. Sparrow on multiple occasions; correct?

A. Yes.
Q. Okay. You did not do that type of analysis with respect to your validation in -- with re -- in your report; correct?
A. Just so I understand the question you're asking. Did I do a validation involv -- or showing a line graph -- or data on a line graph to compare the experiments with the simulation. That's your question?
Q. Yes.
A. The answer is no, I did not.
(Abraham Exhibit 13 marked for identification.)
(Discussion off the stenographic record.)
BY MR. ASSAAD:
Q. What's been marked as Exhibit 13 is an article -- from a chapter from*Numerical Heat Transfer* that you are an author with with Dr. Sparrow and Dr. Minkowycz; correct?
A. That is correct.
Q. And --
A. Oh wait. Hold on. I think that's not correct. That is incorrect.
Q. You did not co-author this with Dr. Sparrow and Dr. Minkowycz?

A. I did.
Q. Oh,*Advances in Heat Transfer*; correct?
A. Correct.
Q. And you do validation to determine the different type of models between K-epsilon, RNG K-epsilon, LES with respect to experimental results; correct?
A. Correct.
Q. And you show validation curves with respect to the -- what the model shows and what the experimental data shows.
A. We show comparisons between the model and the experiment. I don't know if I'd call that a validation curve, but we do show comparisons.
Q. And with the comparisons you have more than two data points; correct?
A. Yes.
Q. And in fact you have between 15 to 20 data points for each comparison; correct?
A. Could you tell me where you're looking?
Q. I'm looking on pages 12, 13, 14, 15.
A. It looks like approximately 20 data points.
Q. And this is com --
This type of depiction of data from the numerical methods of CFD and experimental is commonly

14:15:50 used among people in your field.
14:15:54 **A.** I would agree.
14:18:06 **Q.** Going to your article in*Numerical Heat*
14:18:11 *Transfer*, Exhibit 3, you testified earlier that you
14:18:26 ran at least 2,500 time steps with respect to the 750;
14:18:31 correct?
14:18:32 **A.** Yes.
14:18:34 **Q.** And the time step, I think you recall, was
14:18:37 about .01.
14:18:40 **A.** Well that's -- would -- that, as I recall,
14:18:43 was the time step associated with the 264 TRN.
14:18:46 **Q.** Did you change the time step between 264 and
14:18:49 2500?
14:18:50 **A.** I may have.
14:18:52 **Q.** But sitting here today, you don't recall.
14:18:54 **A.** Well I know I changed the time step, but I
14:18:59 don't recall at what point that was done. The key is
14:19:02 you have to make sure your results are independent of
14:19:04 time step. So whether you change them early or later
14:19:10 isn't that important.
14:19:12 What I say here in the paper is that
14:19:16 multiple values of time steps were selected as low as
14:19:20 .0001 seconds.
14:19:23 **Q.** Well my question is: When you ran it
14:19:25 forward from 264 to 2500, you don't know one way or

14:19:29 the other whether or not you changed the time step.
14:19:30 **A.** I don't recall the time steps between 264
14:19:33 and 2500.
14:19:35 **Q.** And you may not have changed it at all;
14:19:37 correct?
14:19:38 **A.** That's possible.
14:19:51 **Q.** Do you remember, when you ran it, what the
14:19:53 simulation time was at 2500?
14:19:55 **A.** I do not.
14:19:56 **Q.** Was it more than two seconds?
14:19:59 **A.** I don't recall what it was.
14:20:11 **Q.** So sitting --
14:20:13 And I take it you don't have those files any
14:20:15 more; correct?
14:20:16 **A.** Which files?
14:20:16 **Q.** The time step of 2500 for the 750 model.
14:20:20 **A.** I do not have that file for the 750 model.
14:20:24 **Q.** Okay.
14:21:07 (Abraham Exhibit 14 marked for
14:21:07 identification.)
14:21:07 BY MR. ASSAAD:
14:21:19 **Q.** What's been marked as Exhibit 14 is your
14:21:21 Model 750 run at different time steps in which we ran
14:21:31 it forward according to what you testified was
14:21:33 possible in your general causation report -- or at the

14:21:35 deposition.
14:21:42 Do you recognize this format?
14:21:45 **A.** Yes.
14:21:48 **Q.** Do you agree with me that this looks like a
14:21:49 format that would be produced by ANSYS?
14:21:51 **A.** Yes.
14:21:52 **Q.** And it talks about time step simulation
14:21:55 time, CPU seconds, et cetera; correct?
14:21:58 **A.** Yes.
14:22:01 **Q.** And as you see, the first one had a time
14:22:04 step of 951. Do you see that?
14:22:07 **A.** Yes.
14:22:08 **Q.** Okay. And it talks about the equations and
14:22:11 the -- and the rate, the RMS res, the max res and
14:22:17 linear solution; correct?
14:22:18 **A.** Correct.
14:22:19 **Q.** And it also talks about the Courant number;
14:22:23 correct?
14:22:24 **A.** Correct.
14:22:25 **Q.** Point 36 is very high. You agree?
14:22:28 **A.** I don't know if I would agree with that.
14:22:31 **Q.** Is it an acceptable number for you?
14:22:33 **A.** I would have to check numerical instability.
14:22:37 The numerical instability guide -- It might have been
14:22:41 in my report. It's either 1 or .1 is the target, I

14:22:46 just don't recall.
14:22:51 So I -- Sitting here right now I cannot say
14:22:55 whether .36 is high or not high.
14:23:02 MR. GOSS: I'm just going to interpose the
14:23:04 objection that he obviously didn't prepare this
14:23:06 document, but he can answer questions about it if he
14:23:08 understands it.
14:23:17 **Q.** And you see at the top it says a time step
14:23:19 of 1.000E-02; correct?
14:23:26 **A.** Yes.
14:23:27 **Q.** And that's a time step of .01 seconds;
14:23:29 correct?
14:23:29 **A.** Correct.
14:23:30 **Q.** And that's a similar time step that was used
14:23:31 in the 264 TRN file.
14:23:35 **A.** Incorrect. So the -- the --
14:23:39 Remember there's multiple time steps. And
14:23:41 as I said earlier, multiple time steps were used.
14:23:45 That is the time step associated with that TRN file.
14:23:49 **Q.** Yes.
14:23:49 And that's what I asked.
14:23:53 **A.** Okay.
14:23:54 **Q.** The time step that was used in the 264 TRN
14:23:57 file was .01 seconds.
14:23:59 **A.** I agree.

14:24:00 **Q.** And this .01 seconds is what was used in the
14:24:08 264.TRN file.
14:24:09 **A.** It is the time step associated with that 264
14:24:12 TRN file.
14:24:13 **Q.** Now when you go to "Linear Solution" there
14:24:16 is these letter -- it says "OK, OK, OK, OK." Do you
14:24:19 see that?
14:24:20 **A.** Yes.
14:24:20 **Q.** What does that mean?
14:24:22 **A.** That means the computer algorithm is making
14:24:26 satisfactory process on solving the equations, and the
14:24:30 equations are listed on the left, U momentum, V
14:24:34 momentum, W momentum and P mass. So it's giving you
14:24:38 the okay that it's proceeding well on the solution
14:24:42 path.
14:24:46 **Q.** Now if we go to page 4 -- 5, I mean, at the
14:24:57 bottom of the page you see the same type of graph
14:25:02 where it has "Equation," "Rate," "RMS Res," "Max Res"
14:25:06 and "Linear Solution." Do you see that?
14:25:09 **A.** There is no graph.
14:25:11 **Q.** Table.
14:25:12 **A.** Yes, I see a table.
14:25:14 MR. GOSS: So I understand if you're going
14:25:16 to ask him questions comparing this to a similar
14:25:20 document for the 505 model, I understand you may want

14:25:23 to make some comparisons. But obviously to the
14:25:26 extent that this is about the 264 file, that was
14:25:29 general causation.
14:25:30 So I'll give you some latitude here, but I
14:25:33 want to just keep it brief.
14:25:35 MR. ASSAAD: I understand it, but I'll let
14:25:37 you ask questions regarding any changes or additions
14:25:39 in -- in the paper that we didn't have available to
14:25:43 us. We're talking about he says 2500 iterations, so
14:25:47 I think it's a new area.
14:25:49 MR. GOSS: If it's a new area within the
14:25:51 changes described in the paper, then I'll allow it.
14:25:54 BY MR. ASSAAD:
14:25:55 **Q.** What do the "F's" mean?
14:25:57 **A.** It means that it's not making satisfactory
14:26:00 process, so that's a failed linear solution.
14:26:03 **Q.** So you agree with me that the number 951 is
14:26:06 less than 2500.
14:26:09 **A.** I agree 951 is less than 2500.
14:26:12 **Q.** So at time step 951 when you run your model
14:26:18 forward with a .01 second time step, your model begins
14:26:25 to fail, according to this document.
14:26:28 **A.** That's not necessarily true. It depends on
14:26:31 what you mean by "failure."
14:26:34 **Q.** I'm talking about failure as getting Fs on

14:26:38 the table because it cannot solve the pro -- not come
14:26:42 up with a solution.
14:26:43 **A.** No, that's not true.
14:26:46 Failure in CFD means a diverge solution.
14:26:49 This may or may not be a diverge solution or a
14:26:52 converge solution, I don't know without looking at the
14:26:54 results.
14:26:59 **Q.** Well you agree with me that you have
14:27:02 divergence because you're getting an "F."
14:27:05 **A.** No.
14:27:05 **Q.** Okay.
14:27:09 (Interruption by the reporter.)
14:27:28 **Q.** According to you, "F" means that it's not
14:27:31 making satisfactory process, that's -- so that's a
14:27:35 failed linear solution; correct?
14:27:37 **A.** Yes.
14:27:38 **Q.** So "F" means a failed linear solution.
14:27:41 **A.** What "F" means --
14:27:43 **Q.** "Yes" or "no," sir?
14:27:45 **A.** Yes.
14:27:46 **Q.** Okay.
14:27:48 MR. GOSS: Can you tell me where you get
14:27:50 the 951 time step?
14:27:54 MR. ASSAAD: The first page, Peter.
14:27:56 MR. GOSS: Oh, on the first page.

14:27:57 MR. ASSAAD: Four li -- Like, it says "TIME
14:28:01 STEP 951."
14:28:02 MR. GOSS: I see. Thank you.
14:28:25 BY MR. ASSAAD:
14:28:25 **Q.** I represent to you that we've run your code
14:28:28 forward with a .01 time step and your code has crashed
14:28:32 at time step 951 and it could not run forward any
14:28:38 more.
14:28:40 If that is to be true, how is it that you
14:28:43 ran to 2500 time steps, according to your published
14:28:49 paper?
14:28:51 **A.** If that is to be true, then we just have to
14:28:56 go right to the paper where I say, right above
14:29:05 equation 5, "Multiple values of time steps were
14:29:09 selected as low as .0001 seconds (resulting in an RMS
14:29:15 Courant" number "of approximately .001. The Courant
14:29:19 number is defined as," and then I give the definition.
14:29:23 So nowhere here does it say that I ran out
14:29:29 the 264 2500 iterations using the exact same time
14:29:35 step.
14:29:35 **Q.** So the only explanation, sitting here today,
14:29:37 is that you changed the time step to some smaller
14:29:39 number.
14:29:40 **A.** That is an explanation.
14:29:41 **Q.** What other explanations do you have?

14:29:44 **A.** That's the only explanation I can think of now.
14:29:46
14:29:47 **Q.** And you're looking at Exhibit 3; correct?
14:29:50 **A.** Correct.
14:29:56 **Q.** It took you 40 days to run the 750 264 time steps. How long did it take you to run 2500 time steps?
14:30:07
14:30:09
14:30:09 MR. GOSS: Object to form.
14:30:13 **A.** Did I say that it took 40 days to get to 264?
14:30:16
14:30:16 **Q.** Yes.
14:30:17 **A.** When --
14:30:18 I don't recall saying that.
14:30:42 **Q.** Let's go to your deposition, page 184.
14:31:02 Does that refresh your recollection of testifying around 40 days to either get 264 or 300 time steps?
14:31:04
14:31:08
14:31:10 **A.** No. I think you're misreading it, actually, because, as I said in my deposition, and as I pointed out here in this paper, multiple results were calculated and extracted, and in fact I said in my deposition that I had results after 264.
14:31:14
14:31:18
14:31:21
14:31:25
14:31:30 So what I'm saying is the total run took 40 days. I don't recall ever saying that it took 40 days to get to 264.
14:31:33
14:31:42

14:31:45 **Q.** Well you said it took -- line 20: I said we're talking about the 40 days. You say: "It could be 300, it could be 264, you don't know." "Correct."
14:31:50
14:31:52
14:31:56 MR. GOSS: Let's look at lines 18 and 19.
14:32:01 MS. ZIMMERMAN: Look at pages 87 and 88 as well.
14:32:04
14:32:05 **Q.** My question is: Whether it's 264 or 300, you ran 300 time steps -- up to 300 time steps in 40 days; correct?
14:32:08
14:32:14
14:32:15 **A.** That is incorrect.
14:32:16 MR. GOSS: Object to form.
14:32:17 **Q.** Okay. Where does it say here that you ran more than 300 time steps in your -- in this section?
14:32:19
14:32:22 **A.** Well I say I went beyond 264. I don't recall how far I went. But it took 40 days to do the calculation. I'm reading from page 184, lines 18 and 19. So I'm saying I don't remember how long I did the run, but it took 40 days.
14:32:26
14:32:29
14:32:33
14:32:36
14:33:17 MR. GOSS: Let us know when you reach a good point for a break.
14:33:22
14:33:28 **Q.** So you agree with me that if I wanted to know when you changed the time step, I would need the files.
14:33:31
14:33:35
14:33:38 **A.** Or I would have to tell you.
14:33:39 **Q.** But you don't know, sitting here today.

14:33:42 **A.** I don't recall at what point I changed the time step.
14:33:44
14:33:44 **Q.** Okay.
14:33:45 **A.** I recall changing the time step, but not at what point.
14:33:47
14:33:48 **Q.** Okay. So the only way that I would be able to know is if we had the files to look at and looking at the TRN files to see what the time step was.
14:33:50
14:33:52
14:33:55 **A.** That is correct.
14:33:55 **Q.** Okay. So since we don't have the files, we don't know.
14:34:12
14:34:15 **A.** What don't you know?
14:34:16 MR. GOSS: Asked and answered.
14:34:17 **Q.** When the time steps --
14:34:18 When and if the time steps were changed.
14:34:20 **A.** Incorrect.
14:34:21 You know that the time steps were changed because I've said that. And in fact the 264 if it just ran out .01 seconds, the time would have been different from the actual time of the TRN. So you know the time steps were changed, but I cannot tell you, sitting here, when the time steps were changed.
14:34:23
14:34:29
14:34:33
14:34:36
14:34:38
14:34:41 **Q.** Say that again about running the TRN forward?
14:34:43
14:34:44 **A.** No.

14:34:45 **Q.** The time would have been different from the actual time?
14:34:46
14:34:47 **A.** No.
14:34:47 What I said is, we know the time step was changed.
14:34:51
14:34:52 **Q.** How do we know that?
14:34:53 **A.** You know it for two reasons. One, you know it because I --
14:34:55
14:34:56 **Q.** I don't know anything.
14:34:57 So why do you know that?
14:34:58 **A.** I'm going to tell you. There's two reasons: One, I've testified under oath that that's the case. And two, I've given you the 264 time -- TRN file.
14:35:00
14:35:02
14:35:07 If that entire run was made with a time step of .01, then the time associated with that TRN file would be 2.64 seconds, and it's not.
14:35:11
14:35:15
14:35:19 **Q.** Okay, sir, I think we're talking two different things here. I'm talking the time step between 264 and 2500.
14:35:21
14:35:24
14:35:28 Do you have any evidence that you changed the time step from .01 to anything else?
14:35:30
14:35:33 MR. GOSS: Between 264 and?
14:35:37 MR. ASSAAD: 2500.
14:35:38 **A.** I have my recollection, but I didn't record when I changed the time step.
14:35:40

14:35:41 **Q.** And what did you change the time step to?
14:35:43 **A.** I would have used multiple time steps as -- and I would have gone down to .0001 seconds.
14:35:49 **Q.** What other time steps did you use besides .0001?
14:35:53 **A.** It -- I would be guessing, but I would say I probably used .01, .001, .0001.
14:36:00 **Q.** But sitting here today you don't know at what time step you made the change.
14:36:04 **A.** That is correct.
14:36:05 **Q.** And if you made the change, you don't know what changes you made at what time steps.
14:36:10 **A.** That is correct.
14:36:27 **Q.** Why did you change the time steps?
14:36:30 **A.** You want to find results that are independent of time step.
14:36:35 **Q.** Changing the time steps should not cause your results to crash, though.
14:36:38 **A.** It could.
14:36:40 **Q.** Why would it crash?
14:36:41 **A.** If the time steps are too large, the solution could crash.
14:36:43 **Q.** Well I represent to you that we ran it from 264 to 951 and it did not crash until 951. Do you have an explanation for that?
14:36:51
14:36:53
14:37:00

14:37:01 **A.** Yes.
14:37:01 **Q.** What's your explanation?
14:37:04 **A.** It takes -- There's no reason a -- I'm trying to think of how to explain this.
14:37:10
14:37:11 If you have a time step that is too large it doesn't mean the run is going to fail immediately. It might fail immediately, but it might fail far off down the road in time. So I don't know of any way to predict when a computer code will crash based on the time step.
14:37:17
14:37:20
14:37:23
14:37:27
14:37:30
14:37:58 MR. ASSAAD: Let's take a break.
14:38:00 THE REPORTER: Off the record, please.
14:38:02 (Recess taken from 2:38 to 2:50 p.m.)
14:50:08 BY MR. ASSAAD:
14:50:16 **Q.** Going back to Exhibit Number 14. You testified that TRN number 264, at that point in time it reached quasi-steady state; correct?
14:50:29
14:50:44
14:50:46 **A.** Yes.
14:50:49 **Q.** If you're at quasi-steady state, what changes are occurring between 264 and 951 that would cause the CFD to crash if you used a .01 time step?
14:50:51
14:51:03
14:51:08 **A.** If .01 second time step is small enough to ensure stability, there should be no changes, or the changes should be minimal.
14:51:14
14:51:17
14:51:19 **Q.** Well we're at quasi-steady, correct, by 264?

14:51:23 **A.** Yes.
14:51:23 **Q.** Okay. So there's very little change between 264, 265, 266; correct?
14:51:28
14:51:31 **A.** If the calculations are done correctly, then correct.
14:51:33
14:51:35 **Q.** Well we're using ANSYS. Are you saying they're not doing the calculations correctly?
14:51:37
14:51:38 **A.** That's not what I said.
14:51:40 **Q.** You said "if the calculations are done correctly."
14:51:41
14:51:42 **A.** Yes.
14:51:43 **Q.** What calculations?
14:51:44 **A.** The calculations that march forward in time. So, for example, even within ANSYS there are choices to be made, and as long as you make correct choices, and if the calculations are stable, then I would expect no meaningful changes from 264 on.
14:51:48
14:51:51
14:51:55
14:51:58
14:52:01 **Q.** Okay. So if everything was kept the same and you just ran your 264 forward there would be no changes except it running forward; correct?
14:52:03
14:52:08
14:52:11 MR. GOSS: Object to form.
14:52:12 **A.** Yeah, I don't know if I would agree to that.
14:52:15 **Q.** Well you remember testifying in your general cause and earlier today that with the 264 -- with one TRN file you could run it forward because you have all
14:52:17
14:52:21

14:52:24 the information available?
14:52:25 **A.** That's right.
14:52:25 **Q.** Okay. So I represent to you the only thing that we did was run it forward, we didn't change anything, and it crashed at 951. Now if it's at quasi-steady, what is changing to cause it to crash at time step 951?
14:52:31
14:52:33
14:52:37
14:52:40
14:52:42 **A.** Let me explain.
14:52:45 When you march forward in time you have to make sure that your time steps are small enough to ensure stability, and this is called the Courant condition.
14:52:48
14:52:51
14:52:55
14:52:55 **Q.** You picked the .01 time step for 264; correct?
14:52:58
14:53:00 **A.** The .01 --
14:53:01 **Q.** "Yes"?
14:53:02 You picked .01; correct?
14:53:04 **A.** The 264 time step corresponded to a .01 time step.
14:53:08
14:53:09 **Q.** And that's something that you chose?
14:53:10 **A.** That is correct.
14:53:11 **Q.** Okay. You can move on.
14:53:16 MR. GOSS: You can finish your answer, if you weren't finished.
14:53:18
14:53:20 **A.** So as I testified earlier, I chose many time

steps, and in fact we know that some of those time steps are smaller than .01. In fact they were as small as .0001. The Courant number that I see on this page, the maximum Courant number is 26.31. That is above the stability criteria for CFD. So if I were running this case I would not blindly continue to run with a .01 time step, I would look at the actual calculations and I would use my judgment as to when -- whether the time step should be made smaller.

Q. Now could you answer my question?

My question is: If you're at quasi-steady state at 264, which means there's very little change from time step to time step; correct?

A. That is correct.

Q. If any change; correct?

A. Correct.

Q. What would cause your model to crash at time step 951 if nothing is changed from your 264 time step and we just ran it forward, if it's in quasi-steady?

A. We have to separate the issue of quasi-steady and stable. Those are not the same, and I think that you're conflating the two.

You can have a quasi-steady result that then you march forward in time in an unstable manner and it will crash. You can have an unsteady calculation

that's not quasi-steady that you run forward in time and do it appropriately that doesn't crash. So those two things aren't the same.

Q. Because you agree with me that LES is transient, and there's always changes over time.

A. I agree LES is transient.

Q. Now when was the last time you looked at the ANSYS files for the 505?

A. I don't recall.

Q. Did you review them in preparation of today's deposition?

A. I don't believe I did. I don't recall reviewing the ANSYS files, --

Q. Did you --

A. -- but I don't remember.

Q. Did you review any of your models?

A. You know, actually I -- maybe I did review the 505. I think I reviewed the 505 results prior to the deposition.

Q. Do you know what the inlet velocity of the air was used from the diffusers, what the velocity was?

MR. GOSS: In his 505 model?

MR. ASSAAD: Yes.

A. Can I turn to my report --

Q. Of course.

A. -- to see if it was listed there?

I see I gave the flow rate. I don't see the velocity given, but I did give the flow rate.

Q. I represent to you that the velocity -- the mean velocity of the inlet was .177 meters per second. Does that sound about right?

A. Yes, it does.

Q. Okay. Do you know what the distance is between the ceiling and the floor in the operating room?

A. Not without referring to my geometry, I don't know.

Q. I'll represent to you that it's 3.05 meters. Does that sound about right?

A. Yes.

Q. You ran the model for 5.07 seconds; correct?

A. That is the simulation time.

Q. Okay. How far would the air go in five seconds, from the ceiling?

A. In five seconds the air would go approximately a meter.

Q. Would I just multiply 5.07 times .177?

A. That's right.

Q. I represent to you that it's .897 meters.

Does that sound about right?

A. That sounds about right.

Q. Okay. What's the distance between the ceiling and the top of the operating room table?

A. Perhaps a meter and a half or two meters.

Q. So you agree in five seconds the air that's coming in from the inlet doesn't even have enough time to reach the top of the operating room table.

A. I think you're confusing simulation time and streamline time, flow time.

Q. I'm not --

I understand the difference. I'm saying simulation time.

A. I would agree. In five seconds of simulation time the air from the ceiling would not have hit the patient or the operating room table.

Q. Do you recall what the mean velocity of the exhaust of the Bair Hugger blanket is?

A. I recall the -- the flow rate, but I don't recall what the velocity was.

Q. If I tell you, according to your CFD, the mean velocity is .12 meters per second, would you think that's about right?

A. Yes.

Q. In 5.0 seconds how far would the air that

left the Bair Hugger blanket go; what distance?
A. You said the velocity --
Remind me of the velocity.
Q. Point 12.
A. So approximately .6 meters. But again that's using simulation time, not flow time.
Q. Do you agree with me that ANSYS has the capability to track the actual airflow -- not streamlines, but airflow, by just continuing the simulation for a longer period of time?
A. Streamlines are airflow.
Q. Streamlines are instantaneous air flows based on the tangent of the vectors; correct?
A. That is correct.
Q. Okay. You could --
You could have done a simulation for minutes simulation time and followed the actual airflow based on the air coming from the inlets and see where they go without using streamlines; correct?
MR. GOSS: Object to form.
A. Well, I mean, streamlines are the airflow, so I think that that's what I did. And in fact for a quasi-steady calculation the streamlines are nearly equal to the air path lines, so I don't understand the distinction or the difference.

Q. Okay. Well here's where I have a problem with your streamline analogy, is this is a transient flow; correct?
A. Yes.
Q. And the velocity vectors are always changing; correct?
A. Correct.
Q. So a particle that's at a coordinate at time zero, it's going to move based on those velocity vectors; correct?
A. Correct.
Q. And the velocity vectors are going to change at one; correct?
A. Correct.
Q. And now you have a different velocity vector that was in -- at time one than was at time zero; correct?
A. That's correct.
Q. And the particle is at a different coordinate in time; correct?
A. That's correct.
Q. So now you have different forces on that particle that are different than what was at time zero.
A. Correct.

Q. Okay. So since you're in a transient, the streamline only tells you where the air would go if and only if the velocity vectors did not change.
A. If the velo --
I would say this. I think --
Q. Is my statement correct?
A. Your statement's confusing.
Q. Okay. Let me rephrase it, then. If you don't understand it, please let me know.
The streamline will only show particle flow -- and when I say "particle" I'm talking about a massless particle -- if and only if the velocity vectors don't change over time.
A. Not quite true.
To be exact: If the streamline is identically constant over time, then that would be the same path that the fluid would take. If the streamlines change from one position to another, then the particle would take a path that's intermediate of those streamlines.
So I think in your question you said it wouldn't -- would only show the particle flow if and only if the vectors don't change over time. I -- I don't think I would quite agree with that statement.
Q. Okay. Let me rephrase it this way, then.

When you take a snapshot such as the 2540 TRN file, a frame, you have velocity vectors for every single grid cell.
A. Yes.
Q. Okay. And that doesn't change over time because you're not doing anything, you're not moving it forward in time.
A. Correct.
Q. Okay. So --
And then you add streamlines in; correct?
A. Yes.
Q. Okay. And you can follow the streamline, but that -- that particle path is what you want to call it, is only following the velocity vectors for that individual TRN file.
A. At that instant.
Q. Yes.
A. Yes.
Q. But that doesn't happen in reality, because one second from now the velocity vectors change because it's a transient model.
A. There is a slight variation in the velocity vectors, and consequently, in the streamlines.
Q. Okay. So you agree with me that in real life the streamlines that you've put in your images is

15:05:41 not where the particles are going to go.
15:05:42 **A.** I disagree.
15:05:44 **Q.** You're telling me it's going to follow the
15:05:46 exact path of the streamline?
15:05:48 **A.** No.
15:05:49 **Q.** Okay.
15:05:49 **A.** Here's -- Here's what I --
15:05:50 **Q.** And that's my question: It's not going to
15:05:52 follow the exact path.
15:05:55 **A.** It would not follow the exact path.
15:05:57 **Q.** Okay. In your 505 report you refer to a
15:06:35 Shirozu article to validate your results.
15:06:38 **A.** Yes.
15:06:42 **Q.** And if I recall correctly, you indicate that
15:07:00 the Shirozu results closely matched your calculations;
15:07:04 is that correct? Page 7, "INDEPENDENT VALIDATION."
15:07:12 **A.** Yes.
15:07:20 **Q.** Now you agree with me that you are comparing
15:07:26 apples and oranges when you're comparing your CFD
15:07:30 analysis to what Shirozu did.
15:07:34 **A.** Boy, I don't know what the definition of
15:07:36 apples and oranges are.
15:07:37 I would say this: There are some slight
15:07:39 differences in the Shirozu paper to my study, but
15:07:42 those are slight differences, and we agree in our

15:07:46 conclusions.
15:07:47 **Q.** Well we're talking about two different
15:07:52 operating rooms here, aren't we?
15:07:53 (Interruption by the reporter.)
15:07:53 **A.** That is true.
15:07:54 **Q.** You agree with me that in Shirozu the air
15:07:56 exchange was 58 air exchanges per hour.
15:08:00 **A.** Can you show me the Shirozu reference so I
15:08:03 can see?
15:08:03 **Q.** Well do you -- do you recall having a higher
15:08:06 air change rate per hour?
15:08:09 **A.** I don't recall the air change rate per hour,
15:08:11 but if you just show me the paper I'd be happy to see
15:08:14 it.
15:08:14 **Q.** And I will, we'll get to it in a second.
15:08:17 Do you recall what the temperature of the
15:08:18 Bair Hugger was?
15:08:18 **A.** I --
15:08:20 Yes, I do.
15:08:21 **Q.** What was it?
15:08:22 **A.** 38 Celsius.
15:08:23 **Q.** Okay. And that's different than what's been
15:08:25 -- that's different than 43 Celsius that was used in
15:08:30 your CFD simulation.
15:08:31 **A.** Yes, it is different.

15:08:50 (Abraham Exhibit 15 marked for
15:08:50 identification.)
15:08:50 BY MR. ASSAAD:
15:09:05 **Q.** What's been marked as Exhibit 15 is titled,
15:09:08 effects of forced air warming on airflow around the
15:09:10 operating room table.
15:09:12 Is this the Shirozu article that you're
15:09:13 referring to in your report?
15:09:14 **A.** Yes.
15:09:26 **Q.** I want you to go to the last page, page 84.
15:09:32 The last paragraph it states: "It was reported that
15:09:38 excess heat (43 degrees Celsius) from FAW resulted in
15:09:42 the disruption of ventilation airflows over the
15:09:45 surgical site because the release of excess thermal
15:09:48 energy can establish temperature gradients that impede
15:09:51 the downward flow of ultra-clean air."
15:09:54 Did I read that correctly?
15:09:55 **A.** You read that sentence correctly.
15:09:57 **Q.** It continues on: "This temperature setting
15:09:59 might provide different results from our study and
15:10:02 previous studies."
15:10:03 Did I read that correctly?
15:10:05 **A.** Yes, you did.
15:10:06 **Q.** So you would agree with me that these
15:10:08 authors are not making the conclusion that when the

15:10:13 Bair Hugger setting is at 43 degrees Celsius that it
15:10:16 would not affect ultraclean airflow.
15:10:19 **A.** They say what they wrote, and they say it
15:10:21 might provide different results.
15:10:23 **Q.** Okay. So they're not -- they're not saying
15:10:25 --
15:10:25 So my point is, they're not concluding that
15:10:27 the Bair Hugger, at 43 degrees Celsius, would cause no
15:10:30 disruption in the ultraclean room; correct? They're
15:10:33 not saying that, are they, sir?
15:10:35 **A.** I -- I don't think they ever said regardless
15:10:37 of temperature that there's no disruption. But I --
15:10:41 In addition, I say that -- I agree with what they
15:10:44 write.
15:10:45 **Q.** Okay. You agree with what they write.
15:10:47 And let's look at the operating room, sir.
15:10:54 I'd like you to turn to page 80, under "Materials and
15:11:04 Methods." It states: "The capacity of the air
15:11:11 conditioning unit of this OR was planned as total
15:11:14 supply air of 6,000 cubic meters per hour to achieve
15:11:19 International Standards organization cleanliness class
15:11:23 6, resulting in 58.4 air changes per hour."
15:11:27 Did I read that correctly?
15:11:30 **A.** Yes, you did.
15:11:31 **Q.** That is over double the airflow that you

used in your CFD analysis; correct?
A. I don't know. I'd have to do the calculation.
Q. Well if you divided 58.4 by 2 you'd get 29.2; correct?
A. That's correct, except you asked is it the different airflow, and now you're comparing air changes per hour.
The airflow rate, remember this is a different-sized room. So you can't just take the air exchanges per hour in a vacuum, you have to consider it with the size of the OR.
And I just have not done the calculations, so I cannot confirm that it's double, the airflow rate.
Q. The air-exchange rate is over double of what you used in your CFD analysis; correct?
A. I would agree with that.
Q. And you agree with me, if you look at page 81, that the velocity of the air coming from the laminar airflow was .38 to .45 meters per second, under "Results."
A. I agree that the velocity at the measurement locations was .38 to .45 meters per second.
Q. Which is point --

And the velocity being used in your CFD analysis from the inlet air is .177.
A. That's the velocity that I used coming out the vents. And what they're measuring is the velocity some distance away from the vents.
So they're in a similar location but they're not exact. And actually this air accelerates as it goes down into the room. So I would agree that there's some difference, but I would --
Q. "Some difference," or significant difference?
A. I'm not done answering.
I would agree that there is a difference, there is some difference. But it's hard to compare this to my results because they're at different locations.
Q. Well, sir, if it's hard to compare this to your results, how can you indicate, under validation, that their results closely matched your calculations?
A. Let me explain. What I am saying is the velocity that they measured is not at the outlet vent surface, so I am hesitant to compare the 38 and 45 to my 1 -- .17.
Now I will agree theirs is higher, but I will also say you can't make a direct comparison

because they aren't in the same location. And if you notice, I never compared my .17 to their .38 or .45. This paper has three main -- In my mind this paper has three main differences from my work.
Q. Okay. Let me ask --
A. But despite those differences the results are in great agreement.
Q. Okay. You write down: "First, their experimentally measured air speeds (at the head, an upward airflow of 39 centimeters per second and downward airflow of 36 to 45 centimeters per second) closely matched my calculations."
Do you see where I --
A. Yes.
Q. What calculations are you referring to?
A. Those would be the -- the CFD calculations.
Q. And what specific calculation?
A. Well they are the results from the CFD.
Q. Your CFD calculation?
A. Umm-hmm.
THE REPORTER: Your answer, please?
A. Yes.
Q. Okay. So let's go to your CFD calculation. Where do you --
Where is there 39 centimeters per second or

anything close to that number with respect to airflow in your CFD calculations?
A. Well I would --
I mean, I would have to open my CFD, and maybe we will today. But I would look at the downward airflow in these locations and the upward airflow by the head and I would compare them.
Q. And you think that they're close to 39 centimeters per second?
A. I think so.
Q. Well you're the one that's saying it "closely matched my calculations." Do you know whether or not they are?
A. I expect that they are.
Q. Okay. So you expect to find your airflow somewhere in your CFD analysis around 39 centimeters per second.
A. Yes.
Q. And a downward airflow of 36 to 45 centimeters per second.
A. Yes.
Q. So you're telling me that the airflow in your CFD analysis accelerates from the vent of .17 meters per second to 36 to 45 centimeters per second?
A. Well what I'm saying is it's going to be in

15:17:11 that range. I expect that we find my calculated
15:17:13 downward airflow above the operating table to be in
15:17:17 that range.
15:17:18 **Q.** Well how long would it take to accelerate
15:17:23 air from a -- from a diffuser from .17 meters per
15:17:34 second to .36 meters per second?
15:17:39 **A.** I did not investigate how long that would
15:17:41 take.
15:17:42 **Q.** Can you give me an estimate?
15:17:43 **A.** No.
15:17:45 **Q.** Can you do a calculation right now and get
15:17:48 the answer?
15:17:49 **A.** I would not want to do a calculation without
15:17:51 referring to fluid textbooks to make sure I got the
15:17:56 right properties and the right equations. I would not
15:17:58 do a calculation on the fly in a deposition.
15:18:00 **Q.** Well you know what the density of air is, we
15:18:02 could get that off of the CFD; correct?
15:18:04 **A.** Yes.
15:18:05 **Q.** And you know what gravity is; correct?
15:18:07 **A.** I know what gravity is.
15:18:08 **Q.** Okay. And that's 9.8 meters per second
15:18:11 squared.
15:18:11 **A.** That's the gravitational acceleration on
15:18:13 earth.

15:18:13 **Q.** What other forces are causing the air to
15:18:15 accelerate from the diffuser down to the floor?
15:18:17 **A.** You have three forces that are in action:
15:18:20 One is gravity or buoyancy, one is friction, one is
15:18:24 pressure.
15:18:32 **Q.** So sitting here today -- Strike that.
15:18:35 Do you have any notes that you compared the
15:18:38 experimentally measured results from Shirozu to your
15:18:43 CFD analysis?
15:18:44 **A.** I have no notes.
15:18:45 **Q.** Okay. How did you get the Shirozu article?
15:18:48 **A.** I don't recall how I got it. It may have --
15:18:50 I -- I don't know.
15:18:52 **Q.** Did it --
15:18:53 Did the attorneys from 3M provide you this
15:18:54 article?
15:18:55 **A.** They may have. I don't recall.
15:18:56 **Q.** Do you know whether or not they were
15:18:57 involved in funding the study?
15:18:59 **A.** I don't know the answer to that.
15:19:05 **Q.** Were you aware of this study being conducted
15:19:08 before the -- it was published?
15:19:10 **A.** No, I was not.
15:19:24 **Q.** And you agree with me that the Shirozu
15:19:26 article doesn't deal with particles.

15:19:29 **A.** I would agree.
15:19:39 **Q.** And looking at page 80, do you know what's
15:19:44 behind the anesthesia drape in that picture in picture
15:19:48 A?
15:19:50 **A.** I cannot see what's behind the anesthesia
15:19:53 drape in that photograph.
15:19:56 **Q.** Do you know which Bair Hugger was used in
15:20:00 the Shirozu article?
15:20:03 **A.** Yes.
15:20:04 **Q.** Which one?
15:20:05 **A.** It was a Model 750, with -- and it looks
15:20:10 like they used two blanket models, a 522 and a 585.
15:20:16 **Q.** Fair enough.
15:20:16 Do you know with respect to the graphs or
15:20:20 the figures of Figure 2 and Figure 3, which model Bair
15:20:26 Hugger blanket they used?
15:20:48 And I'll represent to you that there's no
15:20:50 indication of what they used, so -- unless you have --
15:20:53 **A.** Well I don't know if that's true. And I am
15:20:55 mistaken, they did use particles.
15:20:58 **Q.** Where do you see particles?
15:20:59 **A.** Visualization of airflow.
15:21:01 **Q.** I'm talking about in their CFD analysis or
15:21:04 their --
15:21:04 **A.** They didn't do a CFD.

15:21:06 **Q.** -- their --
15:21:07 Not the CFD, their experimental analysis.
15:21:09 **A.** Well the visualization is part of their
15:21:11 experimental analysis. They used fine particles
15:21:16 approximately 10 micrometers in diameter, and they
15:21:20 illuminated that with a laser light sheet source.
15:21:25 **Q.** Would that be an acceptable experiment to
15:21:27 conduct?
15:21:30 **A.** Boy, I think so. I've -- I've seen laser
15:21:33 light illuminations before, and if they're done right
15:21:38 they can provide very good information.
15:21:40 **Q.** Okay. No. My question is: With respect to
15:21:42 the type of Bair Hugger blanket that was used, do you
15:21:47 know which ones they used to create the figures of
15:21:51 figure -- Figure 1, Figure 2 and Figure 3?
15:22:06 **A.** For Figure 1 it appears they used the lower
15:22:09 body blanket, and it's my understanding in the other
15:22:28 figures both blankets were used.
15:22:32 **Q.** And why is that your understanding?
15:22:34 **A.** Because they say here, --
15:22:34 **Q.** What page --
15:22:36 **A.** -- "an adult" --
15:22:37 **Q.** What page are you referring to?
15:22:38 **A.** I'm on page 81.
15:22:40 **Q.** Okay.

15:22:40 **A.** "An adult volunteer lay supine on the
15:22:44 operating table and was covered by lower- or
15:22:45 upper-body warming blanket and a general surgical
15:22:50 drape suitable for abdominal surgery or total knee
15:22:55 arthroplasty." And then they talk about the
15:22:58 visualization experiments.
15:23:00 **Q.** I understand that, but do you know, when
15:23:01 they created the figures and obtained the data, you
15:23:06 agree with me that's either a lower or upper body;
15:23:08 correct?
15:23:11 **A.** It could have been both. I mean, let me
15:23:12 read it. Let's see.
15:23:13 **Q.** I mean, it doesn't say lower and underbody,
15:23:16 it says "lower or upper body"; correct?
15:23:25 Sir, I don't want to sit here and waste time
15:23:27 reading this whole article. I mean, you cited it to
15:23:29 support your report.
15:23:33 Do you recall one way or the other whether
15:23:36 or not they used an upper body, lower body or both
15:23:39 during the experiments?
15:23:41 **A.** Without reviewing the article I would be
15:23:43 hesitant to say conclusively whether they used an
15:23:48 upper or lower-body blanket.
15:23:49 **Q.** But any information you would obtain would
15:23:51 be through the article; correct?

15:23:52 **A.** That is correct.
15:23:52 **Q.** And if the article is silent on what Bair
15:23:55 Hugger blanket they used for each of the experiments,
15:24:01 that means we will never know unless we contact the
15:24:05 authors.
15:24:08 **A.** If the article is silent, then I would want
15:24:10 to contact the authors.
15:24:13 **Q.** Are you aware that the underbody blanket has
15:24:16 just been recalled by 3M?
15:24:19 **A.** Do you mean "lower body" or "under body"?
15:24:22 **Q.** I'm sorry. "Lower body."
15:24:23 **A.** I am not aware of any recalls.
15:24:27 **Q.** Do you know whether or not this lower body
15:24:29 blanket that was used in this case was recalled by 3M?
15:24:32 **A.** I do not know.
15:25:09 **Q.** So just so I understand your independent
15:25:12 validation paragraph in Exhibit Number 1, it is your
15:25:17 opinion that the velocities measured at the -- at the
15:25:26 head of the patient closely matches your velocities in
15:25:34 your CFD analysis.
15:25:38 **A.** Yes, that is true.
15:25:39 **Q.** Now when you say the head of the patient,
15:25:41 are we talking about the exhaust from the Bair Hugger,
15:25:45 or the head right above the head?
15:25:51 **A.** I don't know how you'd separate those.

15:25:53 **Q.** Well I'm asking you at what point, what's
15:25:58 your data point?
15:25:59 **A.** Well my data point is this paper, and it's
15:26:01 Figure 2(B), and they show a velocity of 39 near the
15:26:07 head.
15:26:07 **Q.** I'm talking about your data point in your
15:26:10 CFD analysis when you say it's -- it matches your
15:26:13 calculations.
15:26:14 **A.** I would have looked at that -- the
15:26:16 corresponding region, and I would have compared my
15:26:18 results to theirs.
15:26:45 **Q.** So you'll agree that the Bair Hugger causes
15:26:49 -- Strike that.
15:26:50 Are you looking at Figure 2?
15:26:54 **A.** In the --
15:26:55 **Q.** Shirozu?
15:26:56 **A.** Yes.
15:26:57 **Q.** So that's the data you're referring to?
15:26:58 **A.** Yes.
15:27:00 **Q.** Okay. And sitting here today, do you know
15:27:03 whether or not they use an upper-body or lower-body
15:27:09 blanket to create Figure 2?
15:27:10 **A.** Without reviewing the article in detail, I'm
15:27:13 not prepared to answer that question.
15:27:15 **Q.** Well I think that'd be a very important

15:27:17 question, wouldn't it, with respect to direction of
15:27:21 airflow; correct?
15:27:22 **A.** Not necessarily.
15:27:24 **Q.** Well you do understand that the underbody
15:27:26 blanket blows air upwards.
15:27:30 MR. GOSS: Are we talking about "underbody"
15:27:32 or "upper body"?
15:27:33 MR. ASSAAD: Under body, the lower body
15:27:35 blanket.
15:27:36 **A.** I don't think you're right. There are
15:27:38 underbody and lower body blankets, and those aren't
15:27:40 the same thing.
15:28:03 And in fact it's clear here on page 81 in
15:28:06 the exhibit, "An adult volunteer lay supine on the
15:28:11 operating table and was covered by lower- or
15:28:14 upper-body warming blanket," and they missed the S,
15:28:17 but that's okay. So these are above body blankets,
15:28:20 they are not below body blankets.
15:28:43 **Q.** You agree with me that the lower body
15:28:46 blanket was Model 585?
15:28:55 **A.** I agree.
15:28:57 **Q.** The Model 585 is an arthrotomy underbody
15:29:02 blanket, according to 3M's website. Would you
15:29:04 disagree with 3M's website?
15:29:06 **A.** I would not disagree with 3M's website.

15:29:08 **Q.** Okay.
15:29:08 **A.** But they used it as an up -- an above body blanket.
15:29:12 **Q.** And your basis?
15:29:13 **A.** The statement that I just read.
15:29:14 **Q.** I wasn't paying attention because I was reading.
15:29:17 **A.** Okay. I'll read it again.
15:29:19 **Q.** Please do.
15:29:20 **A.** It's page 81: "An adult volunteer lay supine on the operating table and was covered by lower- or upper-body warming blanket"s.
So they clearly used these blankets in the above body manner.
15:29:43 **Q.** Well if the 585 is an underbody blanket, are you aware of whether or not you could use it as a lower-body blanket with -- and put it on top?
15:30:00 **A.** I think you're confusing "lower" and "upper" with "under" and "over."
Would you re-ask your question?
15:30:05 **Q.** Ell can an underbody blanket be used as a blanket that goes over you; do you know one way or the other?
15:30:11 **A.** Yes, I do.
15:30:14 **Q.** Do you know the dimensions of the underbody

15:30:16 blanket?
15:30:17 **A.** I do not know the dimensions of the lower body blanket.
15:30:23 **Q.** Well let's just use the term "Model 585," because it seems that these authors consider it a lower-body blanket, and 3M defines it as an underbody blanket. So let's just use the Model 585. Fair?
15:30:38 **A.** Fair.
15:30:39 **Q.** Do you know the dimensions of the Model 585?
15:30:41 **A.** I do not.
15:30:46 **Q.** Do you know --
Do you know whether or not the air entering the room was laminar?
15:31:19 MR. GOSS: Object to form.
15:31:21 **A.** Yes, I --
15:31:22 **Q.** In the Shirozu?
15:31:23 **A.** Yes, I do.
15:31:24 **Q.** And what's the answer to that?
15:31:25 **A.** The answer is the air for all of these operating rooms is really turbulent. They may call them in industry laminar airflow, but they are always turbulent.
15:32:45 **Q.** And you agree with me that in the Shirozu article they did not have a surgical staff or anesthesiologists in their modeling or in their

15:32:58 experiments.
15:32:58 **A.** I don't know that. I would have to review the article.
15:33:00
15:33:09 **Q.** But if I represent to you there's no indication that they had a surgical team during the measurements, you wouldn't -- you have no reason to disagree with that; correct? You would rely on what the article says.
15:33:22
15:33:22 **A.** I would rely on what the article says.
15:33:29 Now what they say is, on page 84, the first full paragraph, second sentence -- third sentence: "...we did not simulate the movement of surgical, nursing, and other OR staff during the study."
15:33:47 So it may be that they had surgical staff there not moving, or maybe they had mannequins, so it's silent after that.
15:33:55
15:33:57 **Q.** So you don't know one way or the other unless you -- you're going to rely on what the article states; correct?
15:34:01
15:34:02 **A.** I am going to rely on what the article states.
15:34:04
15:34:04 **Q.** Okay. And the article speaks for itself; correct?
15:34:06
15:34:06 **A.** The article speaks for itself.
15:34:18 **Q.** With respect to your 2540 -- Strike that.

15:34:23 With respect to your 505 model, did at any
15:34:28 time you changed from using Boussinesq approximation
15:34:31 to Ideal Gas law?
15:34:33 **A.** I don't recall ever changing that.
15:34:35 **Q.** Can you change that midway?
15:34:36 **A.** Yes.
15:34:38 **Q.** Why would one want to change that midway?
15:34:41 **A.** I don't know why someone would want to
15:34:43 change that midway.
15:34:54 **Q.** Going back to Exhibit 1. If you look at
15:35:13 page 2 of your publication -- I'm sorry. Exhibit 3.
15:35:24 Now Exhibit -- on page 3 of your
15:35:39 publication, those are the same images as page 2 in
15:35:44 your report; correct?
15:35:46 **A.** That is correct.
15:35:47 **Q.** Now that geometry that's used in your
15:35:55 publication and your report is not the same geometry
15:35:57 that was used in your CFD analysis; correct?
15:36:00 **A.** Not quite true. If you remember from the
15:36:02 last deposition, I said that we began by modeling the
15:36:07 flow actually in the exhaust vents, up into the wall,
15:36:11 and the final results were produced without those
15:36:14 exhaust vents and we just had the vents on the wall.
15:36:18 That's the only difference I can recall.
15:36:34 **Q.** And you removed some of the tables and et

15:36:39 cetera; correct?
15:36:41 **A.** I did remove some of the tables and small
15:36:44 features from the original CAD file that were not
15:36:47 relevant to the flow patterns.
15:36:49 **Q.** Is there anywhere in your publication or
15:36:51 your expert report in this case to indicate to the
15:36:54 reader that the geometry was changed that obtained the
15:37:01 results indicated in the following diagrams?
15:37:04 MR. GOSS: Changed from what to what?
15:37:06 Objection.
15:37:07 **Q.** From what's been marked as Figure 1 and
15:37:09 Figure 2.
15:37:12 MR. GOSS: Same objection.
15:37:18 **Q.** Let me rephrase it.
15:37:19 Did you mention anywhere in your
15:37:21 publication, or in your report, that you altered the
15:37:24 geometry of Figure 1 and Figure 2 to perform your CFD
15:37:31 analysis?
15:37:32 MR. GOSS: Are you talking about before he
15:37:34 ran the CFD, or after?
15:37:36 **Q.** At any time.
15:37:38 **A.** Well I mentioned it in my deposition. I
15:37:43 don't know if it's stated -- I don't know if it's
15:37:49 stated here.
15:37:50 **Q.** You agree with me that the readers of

15:37:53 *Numerical Heat Transfer* don't have the luxury of
15:37:56 having access to your deposition.
15:38:00 **A.** I would agree to that.
15:38:17 Oh, hold on. I do say it, actually.
15:38:19 Following Figure 3 I do say: "At the exits, which
15:38:25 were formed by wall-mounted ducting, zero values for
15:38:29 the second derivatives of all transported variables"
15:38:31 are employed.
15:38:33 So here I am saying that for the results
15:38:36 that are shown here there was -- the duct did not
15:38:39 extend into the wall.
15:38:41 **Q.** Now for the 2540 file you also produced a
15:39:13 results file; correct?
15:39:14 **A.** That is correct.
15:39:17 **Q.** And also an output file; correct?
15:39:20 **A.** I believe so.
15:39:21 **Q.** What's the difference between the output
15:39:22 file and the results file?
15:39:24 **A.** The results file has the results, and the
15:39:26 output file is a script, just a listing of what
15:39:29 happened.
15:39:31 **Q.** And the results file will have the results
15:39:33 for each of the time steps; correct?
15:39:35 **A.** That's correct.
15:39:35 **Q.** So I think you ran it to 3,000 something and

15:39:40 it had the results for each of those time steps;
15:39:42 correct?
15:39:43 **A.** I think I saved them every ten time steps.
15:39:45 **Q.** Yeah. Exactly, you're right.
15:39:54 And when were those TRN files created, the
15:39:57 ones after 2540?
15:39:59 **A.** The timestamp would be on them. I don't
15:40:02 recall the exact date.
15:40:27 MR. ASSAAD: Let's take a break.
15:40:28 THE REPORTER: Off the record, please.
15:40:30 (Recess taken from 3:40 to 3:52 p.m.)
15:52:25 BY MR. ASSAAD:
15:52:36 **Q.** I'm going to use your publication because
15:52:40 the pictures are in color. I'd like you to turn to
15:52:53 the Figure Number 1 of your publication, which is
15:52:59 Exhibit Number 3.
15:53:04 If you look at the model, there is a black
15:53:11 area above the head which is where the Bair Hugger
15:53:16 inlet is on your CFD model; correct?
15:53:20 **A.** I believe that is true.
15:53:21 **Q.** Okay. Did you make any changes to that with
15:53:24 re -- in the 505?
15:53:25 **A.** No.
15:53:26 **Q.** Okay. And we discussed this during your
15:53:34 general cause. Have you seen a Bair Hugger blanket in

15:53:43 person?
15:53:44 **A.** Yes.
15:53:45 **Q.** Are you aware there is a plastic sheet that
15:53:47 goes over the head?
15:53:50 **A.** I believe there can be a plastic sheet that
15:53:52 goes over the head.
15:53:54 **Q.** Have you seen the videos provided by 3M
15:53:57 about placing the upper-body blanket over a person?
15:54:00 **A.** I have not seen videos.
15:54:03 **Q.** If the plastic sheet is over the head, would
15:54:05 you agree with me that would affect the airflow in
15:54:09 your CFD model?
15:54:11 **A.** It may. I would have to see the plastic
15:54:13 sheets.
15:54:26 MR. GOSS: I guess I would just object to
15:54:27 the last question.
15:54:37 **Q.** But you're aware there's a plastic sheet so
15:54:39 you've seen it before.
15:54:42 **A.** I don't know if I have seen the plastic
15:54:44 sheet. I -- If -- My recollection is there may --
15:54:47 there may be one and there may not be one.
15:54:47 [Counsel showing the witness an item.]
15:55:04 **Q.** I'll represent to you that this is a 525
15:55:07 extra large upper-body blanket. It's actually a 523.
15:55:22 Have you seen this plastic sheet before

today?
A. I don't know if I've seen this blanket before today. I don't recall seeing this plastic sheet before today.
Q. If that plastic sheet is part of the 522 blanket and placed over the head, would that affect the airflow in your CFD analysis of 505?
A. So just --
MR. GOSS: I was just going to object. Are you saying based on what's modeled or what's not modeled in the 505 model?
MR. ASSAAD: I don't understand your objection. I'm sorry.
MR. GOSS: You're asking if there is a sheet in the blanket, would that affect the airflow in his model. And I'm just objecting I'm not sure that that is in his model.
MR. ASSAAD: In the 522 model?
MR. GOSS: In the 505 model --
MR. ASSAAD: Okay.
MR. GOSS: -- that he -- that the plastic sheet, I'm not aware that it is part of the geometry.
MR. ASSAAD: I understand that.
MR. GOSS: Okay.
Q. So you agree with me that the plastic sheet

is not part of the geometry in the 505 model.
A. I did not include the plastic sheet in my model.
Q. So you agree with me; correct?
A. Yes.
Q. Okay. If the plastic sheet is placed over the head of the patient, would that affect the airflow coming from the inlet of the Bair Hugger in your CFD model?
A. So just so I understand correctly: The patient is underneath, so the patient's head -- now is the patient's head in your hypothetical here, or is it here? [Indicating] Here? Okay.
Q. The sheet is over the patient's --
The plastic clear sheet is over the patient's head.
A. Okay. A plastic sheet like this would not affect my calculations.
Q. Would you agree with me that if the air in the 505 is all coming out of the Bair Hugger inlet, which is basically the neck of the patient, correct, and the back of the patient?
A. Correct.
Q. And that plastic sheet is covering that area, that the airflow would cause some sort of

movement to the plastic sheet?
A. The airflow may cause movement to the plastic sheet, but that wasn't -- I mean, that's a very new question. You didn't ask that before. The airflow may affect the plastic sheet.
Q. Might cause it to waver a little bit.
A. I would have to see it in operation. I would have to see if it's tucked. It may. It's possible it may.
Q. But regardless, you didn't take that into an -- into account in your CFD model; correct?
A. It's --
It wouldn't affect my CFD model, the presence or absence of that sheet.
Q. Well that would be a piece of geometry that's not in your CFD model; correct?
A. That is correct.
Q. Furthermore, with respect to your CFD Model 505, you agree with me that since all the air is coming out of the Bair Hugger inlet, that in reality that setup would not warm the patient.
MR. GOSS: Object to form.
A. I disagree.
Q. Okay. If all the air is leaving the Bair Hugger inlet and not going over the arms or the body

of the patient, how is that going to warm the patient?
MR. GOSS: Same objection.
A. So the Bair Hugger has an inlet that's on the machine which is far away from the operating table, so the Bair Hugger inlet isn't material.
Q. I'm talking about the Bair Hugger inlet as defined in your CFD analysis.
A. Okay. That's not the Bair Hugger inlet, that's the inlet to the room, it's the outlet to the -- of the Bair Hugger.
Q. I understand, but you call -- you call it the Bair Hugger inlet under your -- I'll get the exact name.
You agree with me in ANSYS when water -- when air gets entering into the room it's called an inlet.
A. Yes, I agree.
Q. Okay. So when I use the term "Bair Hugger inlet" I'm talking about the air from the Bair Hugger entering into the room.
A. Now I understand that. But that's -- that's not what I said in my report. For example, I don't see it in my report, but I call -- I'm on Exhibit 3, page 3, the last paragraph. "The warm air from the forced-convection blanket was treated as a second

inlet to the room." So I just want to make sure we are talking about the same thing. I'm not talking about the inlet to the Bair Hugger, I'm talking about the inlet to the room, and I just wanted to clarify that.

Q. And that's what I'm referring to.

And with respect to your modeling, the way you have it set up, all the air that's coming from the Bair Hugger is going out of the Bair Hugger inlet into the room.

A. That is true.

Q. Okay. And none of it is going over the arms of the patient.

A. That is incorrect.

Q. Okay. Where in your -- in your CFD is there an inlet of air going over the arms of the patient?

A. That is not in my CFD, but let me explain how this product works.

Q. Just so I understand you correctly, there is no air in your CFD that's going over the arms of the patient; correct?

A. Correct.

Q. Okay.

A. I did not model the air coming out of the holes that hits the skin. The air comes out and it

impacts the skin all the way along the arm and maybe along the chest, and I guess if they're in a hip replacement it would be like this [indicating].

That air heats the entire arm. Now that air then all migrates upwards via the channels and collects and exhausts into the room by the patient's head, and that's what I modeled in my CFD.

(Abraham Exhibit 16 marked for identification.)

BY MR. ASSAAD:

Q. What's been marked as Exhibit 16 is part of the results file that you provided to us through counsel. Does this look familiar?

A. Yes.

Q. And the reason why I did not produce the entire results file is it's about 3,000 pages. Does that sound about right?

A. They are large.

Q. Okay. And based on --

Well, I'm sorry. It's the output file, not the results file. I'm sorry. Does that sound about right?

A. This is the output file.

Q. Okay. Please correct me when I'm wrong when I'm using terminology regarding ANSYS.

And based on the first couple lines, your name is there; correct?

A. Yes.

Q. With the name of the computer that you used; correct?

A. Yes.

Q. And it's the date that you ran this; correct? Or got this file.

A. Yes.

Q. So these results were obtained on December 22nd, 2017; correct?

A. Yes.

Q. And this was after your expert report was due in this case; correct?

A. Yes.

Q. And are you relying on any of the data to support your opinions of the TRN files that you ra -- that you ran after -- or on December 22nd, 2017?

A. No.

Q. So it doesn't support your opinions in any way.

MR. GOSS: Object to form.

A. I'm relying on the 2540. These -- Any results that I contain -- that I found after that would have just confirmed.

Q. Okay. So at trial you're not going to mention that you rely or that the results confirmed your opinions regarding the 2540; is that true?

A. That question confuses me. Could you re-ask it?

Q. At trial you're not going to testify that the results of the TRN files obtained on December 22nd, 2017 support your opinions in this case.

A. Well I'd say that file 2540 is the basis for my opinion. Anything run after that would confirm my opinion.

Q. Okay. And that is why --

And why did you run it forward in December of 2017?

A. Well I read the transcript from the Motion to Exclude and my understanding is you claimed that you didn't -- plaintiffs were not provided enough information to reproduce the calculations from the TRN file, and so I've demonstrated that you can.

Q. Did you change any setting before you ran it forward?

A. I don't recall if I did.

Q. You agree with me that you did not use the Boussinesq approximation with respect to the 2540 based on this document.

16:06:16 **A.** I don't know if that's true. I would have
16:06:20 to look at this in detail.
16:06:21 **Q.** Well if you look under "LIBRARY," under
16:06:24 "PROPERTIES," "EQUATION OF STATE," it says, "Option =
16:06:27 Ideal Gas." Correct?
16:06:29 **A.** That's right. That's correct.
16:06:30 **Q.** So you used the Ideal Gas model and not the
16:06:32 Boussinesq model; correct?
16:06:34 **A.** On December 22nd, yes.
16:06:35 **Q.** Okay. So you changed from Boussinesq to
16:06:37 Ideal Gas?
16:06:38 **A.** I may have changed from Boussinesq to Ideal
16:06:41 Gas. I don't recall changing it, but I may have.
16:06:46 **Q.** Well, sir, you are an expert -- you claim to
16:06:53 be an expert in this case; correct?
16:06:55 **A.** That is correct.
16:06:56 **Q.** And part of being an expert is to be -- as
16:07:00 an engineer is to be accurate; correct?
16:07:02 **A.** That is correct.
16:07:02 **Q.** And to keep a log or to keep a summary of
16:07:06 any changes you might make with respect to your work
16:07:15 that you did on this case; correct?
16:07:17 **A.** Not necessary.
16:07:18 **Q.** You understand from the last deposition that
16:07:22 I asked you many questions regarding what you did,

16:07:25 what the time steps are, and what changes you made;
16:07:28 correct?
16:07:28 **A.** Yes.
16:07:29 **Q.** Okay. And you would be expecting the same
16:07:32 questions today.
16:07:33 **A.** That is an ex --
16:07:35 I would expect that.
16:07:36 **Q.** Okay. So you knew that if you made any
16:07:38 changes to the 2540 model that I would probably be
16:07:41 asking about it.
16:07:42 **A.** I don't know that would be the case.
16:07:44 **Q.** It would be a very good assumption. Do you
16:07:46 agree?
16:07:46 **A.** I can't make an assumption about what you
16:07:49 would ask in that regard.
16:07:50 **Q.** So regardless, based on the last deposition
16:07:53 and the questions I asked you, you did not keep track
16:07:55 of what changes you made when you ran forward the 2540
16:07:59 model?
16:08:00 MR. GOSS: Objection, form.
16:08:01 **Q.** Or the 505 model?
16:08:02 **A.** I did not keep a log of changes that I would
16:08:06 have made. I don't recall making the change to the
16:08:09 Ideal Gas model, I don't recall it, and it doesn't
16:08:13 matter. It's immaterial to the conclusions.

16:08:16 **Q.** Well doesn't it change whether or not it's
16:08:18 the worst-case scenario for -- for the plaintiffs?
16:08:22 **A.** It changes whether that density term would
16:08:26 overestimate the density forces.
16:08:57 **Q.** And again, if you did not delete all the --
16:09:07 some of the TRN files we would have that information
16:09:09 of any changes that you made with respect to your CFD
16:09:13 analysis; correct?
16:09:14 MR. GOSS: Object to form.
16:09:16 **A.** Well you'd have multiple TRN files so you
16:09:22 would know any changes made with respect to those
16:09:24 multiple TRN files.
16:09:27 **Q.** Simple question, sir. Simple, simple
16:09:30 question.
16:09:31 When did you change from the Boussinesq
16:09:34 approximation to the Ideal Gas?
16:09:36 MR. GOSS: Asked and answered.
16:09:37 **Q.** If you did.
16:09:39 **A.** I don't recall.
16:09:40 **Q.** Okay. You don't know.
16:09:42 **A.** I don't recall when.
16:09:44 **Q.** Do you know if you ran the Boussinesq at all
16:09:47 with respect to the 505?
16:09:48 **A.** I recall running the Boussinesq model for
16:09:52 the 505.

16:09:53 **Q.** For how long?
16:09:54 **A.** I don't know the answer to that. I mean, as
16:09:56 I look at this, it clearly says "Air Ideal Gas," which
16:10:00 is a different way of calculating the buoyant forces,
16:10:03 we've talked about this many, many times. I don't
16:10:08 recall whether the change was made here, on December
16:10:11 22nd, or whether it was made earlier. I just don't
16:10:14 recall.
16:10:15 **Q.** Let's go to page 7, under "BUOYANCY MODEL."
16:10:23 Under "Option" it states "Buoyant"; correct?
16:10:26 **A.** Yes.
16:10:26 **Q.** And that would be consistent with the Ideal
16:10:28 Gas; correct?
16:10:29 **A.** Well, and Boussinesq.
16:10:59 **Q.** Is there anywhere in your report that --
16:11:03 your 505 report which is Exhibit 1, that you received
16:11:06 an error from ANSYS when you ran the model?
16:11:12 **A.** There is no mention of an error from ANSYS
16:11:15 when I ran the model.
16:11:16 **Q.** Let's go to page 10. Page 10, bottom box
16:11:23 states: "ERROR #001100279 has occurred in subroutine
16:11:33 ErrAction message: WARNING: Use of the central
16:11:37 difference advection scheme is strongly recommended
16:11:40 for LES simulations. Another scheme has been used for
16:11:44 one or more equation classes."

Did I read that correctly?
A. You read that correctly.
Q. Do you agree that there's an error code in your CFD analysis of Exhibit 16?
A. I would agree that there's a warning, and there -- the warning is exactly what it says. They recommend central difference advection for LES simulations, and I -- I mean I'm an expert at these things and I determined the central difference advection scheme was not necessary. So it's a warning which I saw and it was not material so I continued the calculation.
Q. Why did you think it was not necessary?
A. Because central difference schemes for advection relate to how the information flows from one element to another. Okay. And how fluid flowing carries information.
If your elements are sufficiently small so that you have mesh independency, the differencing scheme doesn't matter.
Q. When did you make the change from central difference advection to high resolution?
A. I -- I don't know --
Q. Did you make a change?
A. I don't know when or if.

Q. So sitting here today you don't know made a -- you don't know whether or not you made a change?
A. It wouldn't have been necessary, and I wouldn't have recorded when -- when or if a change was made.
Q. Are there any validation papers that use high resolution schemes for LES modeling?
A. Well yes.
Q. Can you name one?
A. Mine.
Q. Which one?
A. My publication in the*Numerical Heat Transfer* where we validated against experiments.
Q. That used high resolution?
A. I would have to go back and check.
Q. Well does it, "yes" or "no"?
A. I -- I don't recall.
Q. Well you just testified, sir --
A. I think it --
Q. -- that your paper --
MR. GOSS: Hold on.
Q. -- was validation for pa -- for papers that use high resolution scheme, you pointed to your paper which is Exhibit 3, and then I asked you, did that use high resolution, and then you say "I don't know."

A. No.
MR. GOSS: Wait -- Wait for a question. Wait for him to ask a question.
Q. What's the truth here doctor?
MR. GOSS: All right.
Q. What's the truth?
MR. GOSS: Let's try a different question.
Q. Do you know whether or not you used central difference advection in your published paper, or high resolution, sitting here today?
MR. GOSS: You can answer that question.
A. I believe I used high resolution, and I'm not a hundred percent sure.
(Abraham Exhibit 17 marked for identification.)
BY MR. ASSAAD:
Q. What's been marked as Exhibit 17 is the file from the 750 model. I would like you to turn to the last page. Do you see where it says, "SOLVER CONTROL: ADVECTION SCHEME"?
A. Yes.
Q. It says "Central Difference" there.
A. Yes.
Q. Does that refresh your recollection of what advection scheme you used in the 750 model?

MR. GOSS: Is this a file that you -- that generated from the 264 TRN?
MR. ASSAAD: Yes.
A. What this file says is that for at least some of the advection equations I used the central difference scheme.
Q. So now you're saying that you went back and forth between high resolution and central advection?
MR. GOSS: Object to form.
A. No. What I'm saying is this document says at least some of the equations were central difference, and this document says that at least one was not [indicating].
Q. Let me -- I think you're a little bit confused here, sir, and I'm going to tell you why.
Document number Exhibit 17 deals with the 750 model. Exhibit Number 16 deals with the 505. So we're doing two different modelings here. You understand that.
A. That's what I understand.
Q. Okay. So can you sit here today and testify, under oath, that you used the central advection scheme when you ran the 505 model?
A. What I can testify under oath is that at least one -- there are many, many, many equations,

16:16:53 okay, so we're not talking about a single equation.
16:16:56 What I can testify under oath is at least one equation
16:16:59 had a different scheme from the central difference
16:17:02 scheme, and that's what it says here.
16:17:04 **Q.** Do you know whether the other equations or
16:17:08 other time steps used central difference advection
16:17:13 scheme in the 505 model, --
16:17:13 **A.** I --
16:17:15 **Q.** -- sitting here today?
16:17:16 **A.** No.
16:17:55 **Q.** You are aware that when you run -- when you
16:17:59 use ANSYS there is a help screen with respect to their
16:18:04 ANSYS guidebook or, like, manual.
16:18:10 **A.** I'm not aware of a help screen.
16:18:12 **Q.** Are you aware of an ANSYS user guide?
16:18:15 **A.** Yes.
16:18:16 **Q.** And if you want to look up or get
16:18:18 suggestions on certain areas you can look it up and
16:18:21 it'll explain what it is.
16:18:23 **A.** Yes.
16:18:23 **Q.** You understand that.
16:18:24 (Abraham Exhibit 18 marked for
16:18:24 identification.)
16:18:24 BY MR. ASSAAD:
16:18:34 **Q.** What's been marked as Exhibit 18 is a

16:18:37 document from ANSYS Release 18.2 which you can see at
16:18:42 the bottom of the page. Do you see that?
16:18:44 **A.** Yes.
16:18:45 **Q.** And it's --
16:18:46 And it's titled "12.3.1 Spatial
16:18:52 Discretization." Is that how you pronounce that?
16:18:55 **A.** Could you...
16:18:57 Oh yes.
16:18:59 **Q.** And then 12.3.1.1 talks about momentum;
16:19:05 correct?
16:19:06 **A.** Yes.
16:19:07 **Q.** And the advection scheme deals with
16:19:09 momentum; correct?
16:19:10 **A.** Yes.
16:19:13 **Q.** And if you look at the second paragraph, it
16:19:16 states: "In order to achieve low numerical
16:19:19 dissipation, you cannot use the standard numerical
16:19:23 schemes for convection that were developed for the
16:19:27 RANS equations (second order upwind schemes, or SOU)
16:19:34 which are dissipative by nature."
16:19:39 Did I read that correctly?
16:19:39 **A.** Yes.
16:19:40 **Q.** And you agree with me that a high resolution
16:19:41 scheme is a Second Order Upwind scheme; correct?
16:19:45 **A.** I would agree.

16:19:46 **Q.** Okay. "In contrast, LES is carried out
16:19:52 using Central Difference...schemes."
16:19:55 Did I read that correctly?
16:19:57 **A.** In fact I think I'm going to read the whole
16:19:59 document so I understand this document.
16:20:02 **Q.** Have you not seen this document before?
16:20:04 **A.** I don't recall seeing this document before.
16:20:22 (Witness reviewing exhibit.)
16:20:49 **Q.** Have you had time to read the section?
16:20:51 **A.** I'm not done yet.
16:20:52 **Q.** Okay. Do you want to take a break to read
16:20:54 it?
16:20:55 **A.** No. (Witness reviewing exhibit.)
16:21:28 Okay. I'm prepared.
16:21:31 **Q.** According to this document it states, in
16:21:33 contrast, LES is carried out using central difference
16:21:36 schemes; correct?
16:21:38 **A.** Correct, but it goes on.
16:21:39 **Q.** And that --
16:21:40 And that is the error that was -- that was
16:21:42 stated in Exhibit Number 16, that the use of
16:21:48 "...central difference advection scheme is strongly
16:21:50 recommended for LES simulations"; correct?
16:21:53 **A.** You truncated the statement.
16:21:55 **Q.** Is what I said correct?

16:21:57 **A.** It is correct and misleading.
16:21:59 **Q.** Okay.
16:22:00 **A.** You truncated the statement.
16:22:01 **Q.** There's no question pending, sir.
16:22:07 MR. ASSAAD: I want to take a break right
16:22:09 now.
16:22:10 THE REPORTER: Off the record, please.
16:22:11 (Recess taken from 4:22 to 4:32 p.m.)
16:32:12 BY MR. ASSAAD:
16:32:47 **Q.** I'd like to go to page -- or Exhibit Number
16:32:51 14. And this is with respect to the 750 model, and I
16:33:00 just want to talk about the max Courant number of
16:33:04 26.31. Do you see that?
16:33:07 **A.** Yes.
16:33:08 **Q.** And you mentioned that was indicative of
16:33:12 instability with respect to the CFD equation solving.
16:33:18 **A.** It may be indicative.
16:33:20 **Q.** Okay. What --
16:33:22 What does the max Courant number indicate?
16:33:26 **A.** There is a stability criteria on it, and I
16:33:30 think it is the equations are stable if the max
16:33:36 Courant number is below 1. I don't remember the exa
16:33:39 -- I think it's 1. What that means is if you have a
16:33:42 max Courant number above that you just have to watch
16:33:44 it and see if it's stable or not.

16:33:47 **Q.** Okay. So 26.31 may be unstable.
16:33:52 **A.** It could be.
16:33:53 **Q.** Okay. What about a hundred?
16:33:55 **A.** It would be more likely to be unstable.
16:33:58 **Q.** What about 500?
16:33:59 **A.** More likely.
16:34:01 **Q.** At what point would you say it's unstable, what max Courant number?
16:34:05 **A.** You use the results. You can't just -- There isn't a defining line in the Courant number that says it's stable or unstable. The guidelines are 1 or above you've got to watch it, 1 or below you have higher confidence it'll be stable.
16:34:19 **Q.** Okay. Going to Exhibit Number 16. I'd like you to turn to the second-to-last page. And this is your output file that you provided to us through a subpoena. And it shows a max Courant number of 973.49; correct?
16:34:56 **A.** Incorrect.
16:35:03 **Q.** Oh, it's an acoustic Courant number; correct?
16:35:07 **A.** Correct.
16:35:07 **Q.** What's the difference between the acoustic Courant number and the max -- and the regular Courant number?

16:35:13 **A.** I believe, and this is not with absolute certainty, that the acoustic Courant number refers to the passage of sound waves. The Courant number, which is to the left of that, is what we use to determine stability.
16:36:40 **Q.** We've also received images of airflow that you created for the different time steps. Do you recall creating some?
16:36:55 **A.** Yes.
16:36:58 (Abraham Exhibit 19 marked for identification.)
16:37:15 (Discussion off the stenographic record.)
16:37:16 BY MR. ASSAAD:
16:37:23 **Q.** Now Exhibit 19 is a document that was provided to us in response to our subpoena. Does this document look familiar?
16:37:30 **A.** Yes.
16:37:31 **Q.** And on the upper left-hand corner it says, "Time on Below Table partiles." I assume that's supposed to be "particles"; correct?
16:37:41 **A.** Correct.
16:37:42 **Q.** Now that's a description that you entered manually; correct?
16:37:47 **A.** Incorrect.
16:37:48 Well what do you mean by "description"?

16:37:51 **Q.** Like "time on below table particles."
16:37:55 **A.** Yes. That text I wrote.
16:37:58 **Q.** Okay. That wasn't created by ANSYS; correct?
16:38:01 **A.** Correct.
16:38:02 **Q.** And what we're seeing here are streamlines; correct?
16:38:05 **A.** Correct.
16:38:08 **Q.** And it's showing you the streamlines for 60 seconds; correct?
16:38:12 **A.** Correct.
16:38:12 **Q.** And this was created in December of 2017; correct?
16:38:18 **A.** Yes.
16:38:19 **Q.** Okay. After your expert report was submitted; correct?
16:38:24 **A.** Correct.
16:38:27 **Q.** And this is what you were saying that you are relying upon showing the streamlines for 60 seconds; correct?
16:38:35 MR. GOSS: Object to form.
16:38:36 **A.** Incorrect.
16:38:37 **Q.** You're not relying on any of these images?
16:38:39 **A.** No. What I -- I think I said this earlier, and I'll -- maybe I didn't say it very clearly.

16:38:45 For my opinion in the supplemental report I'm only relying on the 2540. These extra images are just to show that the flow patterns are not changing over time. So they confirm my results, but I'm not relying upon them.
16:38:58 **Q.** Oh, I understand that.
16:39:01 But I'll represent to you --
16:39:05 (Abraham Exhibit 20 marked for identification.)
16:39:05 BY MR. ASSAAD:
16:39:27 **Q.** -- that Exhibit Number 20 is the graphical representation of streamlines for the 2540 TRN file. Fair enough?
16:39:40 MR. GOSS: Is this one that we produced to you, or one you generated from the TRN file?
16:39:46 MR. ASSAAD: This is what you produced to me, --
16:39:47 MR. GOSS: Okay.
16:39:48 MR. ASSAAD: -- and for the record, you produced streamlines at 60 seconds for 2440, 2450, 2540, 2750, 3250, 3400, 3500, and 3630.
16:39:57 **Q.** Does that sound about right?
16:40:06 **A.** Yes.
16:40:08 **Q.** Okay. Are you relying on the streamlines you prepared for the 2540 to show the 60-second
16:40:08
16:40:11

streamlines of that particular TRN file?
A. Yes.
Q. And this was created in December of 2017; correct?
A. This image was.
Q. Okay. And after your expert report was submitted; correct?
A. Correct.
Q. And this was provided to us last week.
Do you know when this was provided to plaintiffs?
A. I do not know.
Q. And you are not going to rely upon, for your expert opinion in the Gareis case, on any other graphical depictions of streamlines for other time steps; correct?
MR. GOSS: Other than 2540.
Q. Yes.
A. Correct.
Q. And you used the term "particles," but these are streamlines, not particles; correct?
A. That is correct.
Q. So you would agree with me that the use of "particles" is inappropriate in describing this graph; correct?

A. It may be. I'd have to think about whether it's inappropriate. But these --
I would say this. These are streamlines.
Q. Okay. You're familiar with the capabilities of ANSYS; correct?
A. Yes.
Q. And you are aware that you could take two different time steps and ANSYS could graph the delta or the change between the two if you want to look at velocity or temperature.
A. That may be true. I don't know if that's true, but it might be.
Q. So you've never done that?
A. I have never done that.
(Abraham Exhibit 21 marked for identification.)
BY MR. ASSAAD:
Q. Exhibit 21 is a view looking from -- towards the head of your geometry in the 2540 TRN file. Does this look familiar?
A. Yes.
Q. Would you agree with me that where it's the color red is the Bair Hugger inlet where the exhaust air is coming -- is coming out of the Bair Hugger blanket in your CFD model?

A. That is the...
I would say this. That is where the air from the Bair Hugger enters the room.
Q. Okay. And that's a two-dimensional plane; correct?
A. Yes.
Q. I'm going to represent to you that we actually ran your 2540 TRN file forward for a hundred seconds of simulation time.
(Abraham Exhibit 22 marked for identification.)
MR. GOSS: I'm going to object as vague to "simulation time," because I'm -- I may be confused about what that means.
Q. Sir, do you understand when I use the term "simulation time"?
A. I am not certain what you mean.
Q. You understand that TRN 2540 had a simulation time of 5.07 seconds.
A. If you're using it in that context, then I understand "simulation time."
Q. Can we agree that for the purposes of this deposition that definition of simulation time can be used?
A. Yes.

Q. Okay.
MR. ASSAAD: We need to take a break because I need to make sure I have the right pictures in front of me and I need to talk to my consultants.
THE REPORTER: Off the record, please.
(Recess taken from 4:48 to 4:50 p.m.)
BY MR. ASSAAD:
Q. I want to discuss your mesh that you used in the 505.
(Abraham Exhibit 23 marked for identification.)
BY MR. ASSAAD:
Q. What's been marked as Exhibit 23 is a cross-sectional view of your mesh. Do you recognize this mesh?
A. I don't recognize this image. I don't know exactly where it was taken in the model. It appears to be a mesh from -- It may be a mesh from the CAD file, but I don't recognize this image.
Q. Well this is a --
I'll represent to you this is the mesh taken from your 2540 file that was provided to us by your attorneys.
A. And I understand that. I'm saying I don't recognize this image.

16:52:00 **Q.** Now when I'm looking at this mesh it seems
16:52:03 like the mesh is more fine in one area over the rest
16:52:06 of the area. Do you see that?
16:52:09 **A.** I would say it's more fine in some areas,
16:52:11 less fine in others.
16:52:13 **Q.** Okay. You created the mesh; correct?
16:52:31 **A.** Yes.
16:52:31 **Q.** And part of creating the mesh is to create a
16:52:37 finer mesh in areas in which you want to have more, I
16:52:44 guess for lack of a better term, clarity of what's
16:52:46 going on?
16:52:48 **A.** You could say it like that.
16:52:50 **Q.** Okay. Why did you pick that --
16:52:51 There's a section there that's a very fine
16:52:54 mesh, kind of looks like a square, to the left of the
16:52:57 operating room table. Do you see that? Or rec --
16:52:59 looks rectangular?
16:53:00 **A.** Yes.
16:53:02 **Q.** Why the is the mesh in that area much finer
16:53:04 than the rest of the air in the operating room?
16:53:07 **A.** I'm going off memory, which is imperfect,
16:53:11 but I probably wanted a refined mesh in that area
16:53:15 where I anticipated Bair Hugger air would be
16:53:20 exhausted.
16:53:21 **Q.** Okay. So based on your mesh that was what

16:53:32 your hypothesis was with respect to where the Bair
16:53:36 Hugger air was going to be exhausted; correct?
16:53:38 **A.** No. I think --
16:53:39 MR. GOSS: Object to form.
16:53:40 **A.** -- you have it backwards.
16:53:48 **Q.** Okay. What did I misunderstand?
16:53:50 **A.** You said based on the mesh that's where I
16:53:53 expected the Bair Hugger air to be exhausted, and I
16:53:56 would flip it and say, I expect the Bair Hugger air to
16:54:01 be exhausted there, therefore I created a finer mesh
16:54:03 there.
16:54:04 **Q.** Okay.
16:54:52 (Abraham Exhibit 24 marked for
16:54:52 identification.)
16:54:52 BY MR. ASSAAD:
16:54:53 **Q.** Exhibit 24 is a temperature gradient of the
16:54:56 operating room. I don't have the scale on the
16:55:00 temperature, it's kind of irrelevant to my questions
16:55:03 here.
16:55:04 But my question is: You ran the model for
16:55:08 5.07 seconds. Why is there heat on the upper
16:55:20 right-hand side of the operating room when the Bair
16:55:25 Hugger is exhausting on the left-hand side?
16:55:27 **A.** There's a simple explanation for that, but I
16:55:30 first want to correct your question. The temperature

16:55:33 scale is totally relevant. A proper temperature scale
16:55:37 would be like one of the ones that I show in my report
16:55:39 with numbers, and you can see that the temperature
16:55:43 scale is uniform so every number represents a
16:55:46 different value of temperature.
16:55:48 Here, how do we interpret what red, blue,
16:55:52 green, yellow means? In fact we don't even know if
16:55:55 the temperature scales are uniform. With that
16:55:58 statement, the reason -- and in fact in this report,
16:56:02 and in fact in the first deposition we talked about
16:56:04 this, why is air near the top of a room warmer than
16:56:08 air near the bottom, and that is the old adage, heat
16:56:11 rises. Hot air rises. So if you were to measure or
16:56:16 calculate the temperature in a room with buoyancy,
16:56:19 you'd find it warmer at the top, cooler at the bottom,
16:56:22 just like in this room.
16:56:24 **Q.** All right. Let's do this. Unfortunately
16:56:26 everything we printed did not come up with the scale,
16:56:29 so I'm just going to show it on the big screen.
16:56:36 (Discussion off the stenographic record.)
16:56:39 MR. ASSAAD: Another break, and I
16:56:42 apologize.
16:56:43 THE REPORTER: Off the record, please.
16:56:45 (Recess taken from 4:56 to 5:06 p.m.)
17:06:40 BY MR. ASSAAD:

17:06:49 **Q.** With respect to the streamlines that you
17:06:54 placed in your 505 model, am I correct that you began
17:07:01 streamlines from the exhaust air of the Bair Hugger;
17:07:09 correct?
17:07:14 **A.** I began streamlines from two locations.
17:07:18 **Q.** I understand that, but one of them was from
17:07:20 the exhaust air of the Bair Hugger; correct?
17:07:21 **A.** Correct, where the Bair Hugger air entered
17:07:24 the room.
17:07:24 **Q.** Yes. Would that --
17:07:26 Which would be that red area on Exhibit
17:07:27 Number 21.
17:07:31 **A.** Yes.
17:07:32 **Q.** Okay. And the other area would be from
17:07:36 underneath the operating room table; correct?
17:07:42 **A.** Correct.
17:07:43 **Q.** And that would be from where the legs are;
17:07:45 correct?
17:07:47 **A.** I can see part of it in this image. Part of
17:07:51 the zone extends beyond the surgical table
17:07:53 approximately at the knee or thigh.
17:07:55 **Q.** So from the knee or thigh back; correct?
17:07:58 **A.** Well, and it would have gone both
17:08:01 directions. From this image we don't see how far it
17:08:04 goes in both directions, but it -- we -- we see the

17:08:07 part that is by the knee or thigh, we don't see how
17:08:11 far it extended in the other directions.
17:08:13 **Q.** Okay. And you agree when air enters the
17:08:18 operating room it's going to have affect on the entire
17:08:24 operating-room airflow.
17:08:27 **A.** I don't know if I would agree with that.
17:08:29 **Q.** Are there any dead zones in the operating
17:08:31 room?
17:08:32 **A.** Define a dead zone.
17:08:33 **Q.** Where there --
17:08:34 A recirculation zone, maybe that's a better
17:08:37 term.
17:08:37 **A.** Yes. A recirculation zone, though, is not a
17:08:40 dead zone.
17:08:41 **Q.** Okay. Are there any recirculation zones in
17:08:43 the operating room --
17:08:44 **A.** Yes.
17:08:44 **Q.** -- in the model?
17:08:46 Where?
17:08:49 **A.** If you look to Exhibit 1, Figure 5.
17:08:55 **Q.** Okay.
17:08:56 **A.** That figure shows recirculation zones.
17:08:59 **Q.** Where?
17:09:00 **A.** The vectors shown there show the direction
17:09:04 of airflow patterns. The airflow is coming down from

17:09:08 the ceiling, it washes over the surgical table against
17:09:11 the wall -- against the floor, sorry, toward the wall,
17:09:14 and then rises at the wall. So those are eddies,
17:09:17 those are recirculation zones.
17:09:18 **Q.** Okay. And there's also a recirculation zone
17:09:26 underneath the operating room table; correct?
17:09:28 **A.** That is correct.
17:09:29 **Q.** Okay. Can you please highlight, on Exhibit
17:09:35 1, where there are recirculation zones?
17:09:49 **A.** (Witness complying.)
17:10:00 THE WITNESS: Do I need to show you?
17:10:01 **A.** I don't know if I need to show anyone.
17:10:04 **Q.** That's fine.
17:10:05 **A.** Okay.
17:10:32 **Q.** Now you provided TRN files from 2540 to --
17:10:45 I'm sorry -- from 2440 to 3630; correct?
17:10:52 **A.** Correct.
17:10:52 **Q.** And I'm not saying you provided them all.
17:10:54 You provided about, you know, a handful; correct?
17:11:03 **A.** I don't know what "a handful" is. I
17:11:04 provided many TRN files in that range.
17:11:08 **Q.** And the last TRN file that you provided was
17:11:11 time step 3630. Does that sound about right?
17:11:14 **A.** That sounds about right.
17:11:15 **Q.** Okay.

17:11:19 (Abraham Exhibit 25 marked for
17:11:40 identification.)
17:11:40 (Discussion off the stenographic record.)
17:11:41 BY MR. ASSAAD:
17:11:43 **Q.** I'll represent to you that Exhibit Number 25
17:11:46 is a comparison between time step 2540 and 3630. And
17:11:58 sitting here today you were unaware that -- or you're
17:12:00 not sure whether or not you could do a comparison
17:12:04 between two time steps in ANSYS.
17:12:05 **A.** No, I know you can do comparisons. I didn't
17:12:07 know that you could do a -- that ANSYS would spit out
17:12:10 a comparison contour graph. I didn't know that this
17:12:13 was automated.
17:12:14 **Q.** Okay. And what we're showing here is
17:12:18 temperature, velocity, and vector change -- changes
17:12:24 between the 3630 TRN file and the 2540 TRN file.
17:12:31 Do you understand what I'm saying?
17:12:32 **A.** Yes.
17:12:32 **Q.** Okay. And it's only showing deltas. Do you
17:12:37 understand that?
17:12:37 **A.** It is showing a temperature difference.
17:12:39 **Q.** Okay. You agree with me that ANSYS is
17:12:44 showing a temper -- there is a temperature difference
17:12:49 in page 1 of Exhibit Number 25 between the 3630 TRN
17:12:54 file and the 2540 TRN file.

17:12:56 MR. GOSS: Just object to the lack of
17:12:58 foundation. You can answer.
17:12:59 **A.** I would agree, and I even said that it's
17:13:03 essential. This has to happen in an unsteady flow.
17:13:06 **Q.** Okay. So you agree with me --
17:13:07 You don't disagree that there would be a
17:13:09 temperature difference such as depicted in Exhibit 25.
17:13:13 **A.** I would agree that there has to be a
17:13:17 temperature difference between any two TRNs such as
17:13:20 the one we're seeing here.
17:13:22 **Q.** Okay. And I represent to you that this is
17:13:25 not something that we created, this is based off of
17:13:27 your TRN files that you provided to us or your counsel
17:13:32 provided to us last week in -- as a response to our
17:13:34 discovery requests.
17:13:35 Do you also see, if you turn to the velocity
17:13:40 graph, that there's also a change over time in
17:13:48 velocity between the 2630 TRN and the 2540 TRN?
17:13:56 **A.** And I give the same answer. There has to be
17:13:58 a small change from one TRN to the other.
17:14:01 **Q.** Okay. So you agree with me that there's a
17:14:04 change.
17:14:05 **A.** I -- I'll do more than that. I'll say there
17:14:08 has to be a change.
17:14:10 **Q.** Okay. And you agree with me, if you look at

page three, that there's also a change in the velocity vectors between the 2540 TRN file and the 3630 TRN file.

A. And I would say there has to be a change.

MR. GOSS: I'm just going to object just because I'm confused about what the difference is between page 2 and page 3.

Q. Do you understand the difference between velocity value and velocity vector?

MR. GOSS: Oh, I see. Never mind. I follow.

MR. ASSAAD: And with all due respect, a lack of understanding is not a valid ob -- is not a legal objection.

MR. GOSS: Well it sounded vague because I didn't understand.

(Laughter.)

MR. GOSS: Now I understand.

MS. ZIMMERMAN: I'm there with you.

MR. GOSS: All right.

Q. Do you know what the simulation time was for the 3630 TRN file?

A. I do not know it off the top of my head.

Q. Now --

(Abraham Exhibit 26 marked for

identification.)

(Discussion off the stenographic record.)

BY MR. ASSAAD:

Q. What's been marked as Exhibit 26, I will represent to you, is us running your model forward up to six seconds of simulation time.

So --

MR. GOSS: 2540.

MR. ASSAAD: 2540.

Q. So basically we're looking at the delta between 5.07 seconds and 6 seconds. Do you understand that?

A. Yes.

Q. Okay. And do you agree with me that you are seeing a change in temperature, velocity, and velocity vectors in Exhibit 26?

A. I agree that this exhibit shows a difference in temperature, velocity, and velocity vector.

Q. Okay. And we're talking about a change in less than one second.

A. You're representing that to me, so I take you at your word.

Q. And just to let you know --

Or let me ask you this. Would you disagree that if your 3630 TRN file states that the simulation

time -- Withdraw that question. I'm getting tired.

Your simulation time, according to your 3630, is 5.1799 seconds. Is there any reason that you would disagree with that?

A. No.

Q. I'm sorry. 6.859 seconds. Would you disagree with that at all?

A. I would not.

Q. Okay.

MR. GOSS: Just to be clear for the record that 6.859 seconds is associated with the 3630 TRN; is that right? Or did I get that wrong?

MR. ASSAAD: Yes, the 3630 is 6.7859 seconds.

Q. So you agree with me that in less than one second there is a change in velocity, temperature, and velocity vectors.

A. In fact I'll go further. There has to be some change.

Q. Okay. Because it's a transient model; correct?

A. That is correct.

Q. And you agree with me that velocity vectors are going to change the streamlines.

A. Yes.

(Abraham Exhibit 27 marked for identification.)

BY MR. ASSAAD:

Q. Exhibit 27, I represent to you, is a comparison between your 2540 TRN file and a TRN file that went out a hundred seconds of simulation time.

Do you understand that?

A. Because you've told me.

Q. Okay. And if you look at the temperature delta, you see that there are more areas of changing temperature than the other deltas in the other two exhibits; correct?

A. I don't know if I'd agree with that.

Q. You do see that there's a change in temperature; correct?

A. I do.

Q. And you also see that there's a change in velocity; correct?

A. Yes.

Q. And you also see that there is a change in the velocity vectors.

A. Yes.

Q. Okay. And if you compare Exhibit Number 27 to Exhibit Number 25, looking at the delta and velocity vectors, there's a significant change in

velocity vectors as the simulation runs longer; correct?

A. I would disagree.

Q. Okay. Do you see significant change on the right-hand side of the operating room depicted in Exhibit Number 25, page 3?

A. I do not.

Q. Do you see --

You do understand that there are more -- there's more color in Exhibit 27 as there is in Exhibit 25 when looking at the velocity vector difference.

A. I disagree.

Q. You disagree?

You understand that the scales are different between Exhibit 25 and 27; correct?

A. Yes.

Q. And Exhibit 27 the scale goes from zero to .67; correct?

A. Incorrect.

Q. What's the scale on Exhibit 27 for velocity vector difference?

A. Zero to .6378.

Q. You're right. I misspoke.

And the scale with respect to Exhibit 25

goes from zero to .1781; correct?

A. That is correct.

Q. And if you put the exhibits next to each other so that the camera can see, the overhead camera.

THE VIDEOGRAPHER: You can just keep them right there.

Q. You can keep them right there.

Do you see a difference, a visual difference between Exhibit 27 and Exhibit 25?

A. Yes, I do.

Q. And you see more color, or more areas of color in Exhibit 27 than Exhibit 25; correct?

A. I would agree that there are more areas of color.

Q. And you agree with me that the delta in vector -- velocity vectors increases over time.

A. I -- You cannot make that conclusion from these two.

Q. Okay.

A. Would you like me to explain?

Q. Not yet.

You agree with me that there are some areas of red on Exhibit 27; correct?

A. In the contour legend there is an area of red.

Q. And there's a little bit of red kind of above the, like the upper left-hand corner; correct? Orange red?

A. Well that's the contour legend.

Q. I'm talking about in the operating room, in the orange -- orangish-red.

A. I would say it's light orange.

Q. Okay.

A. I would say it's yellowish orange, but I think we're quibbling over color.

Q. And as you said before, you would expect over time the temperatures and velocity and the velocity vectors would change because this is a transient model.

A. I would expect --

Well they have to.

Q. And since velocity vectors, temperature and velocity will have an effect on streamlines, the streamlines will change over time.

A. And as I've said, they have to.

Q. Okay. Did you ever attempt to start your streamlines at a different point besides the -- underneath the operating room table or from the exhaust of the Bair Hugger?

A. Yes.

Q. And did you find any streamlines going over the surgical site?

A. In this journal paper which is Exhibit 3, I show photographs of streamlines that are started at two locations not the two you've listed. And this is in Figures 12 and 13.

MR. GOSS: I assume your question wasn't limited to 2540.

MR. ASSAAD: It was, but since we're going to go -- since he started, I'm going to follow up just a little bit.

MR. GOSS: That's fine.

BY MR. ASSAAD:

Q. So in Figures 12 and 13 you show streamlines coming from the Bair Hugger hose?

A. No.

Q. Or the -- the vapor generator?

A. Yes.

Q. And where did those streamlines start from?

A. They started from the exit of the vapor generator's hose.

Q. And did you run a new model to get these streamlines?

A. No.

Q. How'd you get these streamlines?

17:27:12 **A.** I released streamlines from the approximate
17:27:15 location where that hose was.
17:27:17 **Q.** Okay. And this wasn't in your original
17:27:19 report that was submitted in the Court; correct?
17:27:22 **A.** That is correct.
17:27:25 **Q.** Did you try running streamlines from
17:27:27 anywhere else?
17:27:29 **A.** Not that I recall.
17:27:41 Oh yes, actually. I ran streamlines from
17:27:43 the ventilation system.
17:27:45 **Q.** I understand. Okay.
17:28:02 Now going to your report, I want you to turn
17:28:08 to Figure 7, Exhibit 1. And that's showing
17:28:25 temperature gradient as a result of the warm air
17:28:29 coming out of the Bair Hugger; correct?
17:28:31 **A.** No.
17:28:32 **Q.** What's it showing?
17:28:33 **A.** It's showing temperature.
17:28:35 **Q.** Okay. So it's showing temperature at the
17:28:38 Bair Hug -- of the air as the -- of the -- of the --
17:28:43 around where the Bair Hugger is exiting warm air;
17:28:45 correct?
17:28:46 **A.** Yes.
17:28:57 **Q.** And if you look at...
17:29:09 I don't think you have it in your report,

17:29:11 but you agree with me that if you followed the
17:29:14 streamlines looking at the same view of Figure 7, you
17:29:19 would see the streamlines are moving upward direction;
17:29:22 correct?
17:29:24 **A.** In the general upward direction, correct.
17:29:27 **Q.** Because of buoyancy; correct?
17:29:29 **A.** Correct.
17:29:30 **Q.** Okay. And you agree with me that there's
17:29:36 enough buoyancy in the air coming from the Bair Hugger
17:29:42 exit that overcomes the downward air coming from the
17:29:50 inlets --
17:29:51 MR. GOSS: Object to form.
17:29:52 **Q.** -- at that -- around the Bair Hugger --
17:29:54 around the surgical drape.
17:29:56 **A.** I would disagree.
17:29:57 **Q.** Okay. So the air is not going up?
17:30:04 **A.** That's not your original question.
17:30:07 **Q.** Okay. The streamlines are -- would
17:30:08 basically go up as a result of buoyancy; correct?
17:30:11 **A.** They go in the general upward direction.
17:30:13 **Q.** Okay. Until the air cools down, and then it
17:30:18 would change direction; correct?
17:30:20 **A.** That would be one reason why it may change
17:30:23 direction.
17:30:24 **Q.** Okay. You do agree that right above that

17:30:28 surgical -- the -- the pole there, to the right of it
17:30:32 is a ventilation duct blowing cold air down. Do you
17:30:38 see that?
17:30:40 **A.** Yes.
17:30:40 **Q.** Okay. So even with the air going down from
17:30:46 the diffuser inlet, the air coming out of the Bair
17:30:51 Hugger still has an upward direction; correct?
17:30:54 **A.** Well I think you misstate -- you
17:30:56 misunderstand what's shown here. What's shown here is
17:31:02 -- And in fact I want to make sure this is clear for
17:31:04 the camera.
17:31:06 The warm air comes out and it's basically
17:31:09 going horizontal. Now why is it going horizontally?
17:31:14 Because it is pushed horizontally by the air coming
17:31:17 out of the ventilation, which is right here
17:31:20 [indicating]. When the warm air moves beyond that
17:31:23 ventilation area only --
17:31:24 **Q.** Dr. Abraham, just one quick --
17:31:26 I'll let you finish, but I'm not your
17:31:28 student. Just answer the question. So don't -- You
17:31:31 know, don't teach, just answer my question as to why
17:31:33 the air is -- is going up or I'm misunderstanding
17:31:38 something.
17:31:38 **A.** Could you restate the question?
17:31:39 **Q.** Sure.

17:31:50 And I'm going to break it in parts just so
17:31:52 we're clear. The air --
17:31:54 There is a diffuser right above and to the
17:31:58 right of the pole that's blowing 15 degrees Celsius
17:32:02 air downwards; correct?
17:32:04 **A.** I don't know if it's directly above the
17:32:07 pole. There is a diffuser in the ceiling, but I can't
17:32:11 say if it's directly above the pole, because the
17:32:15 diffusers are not continuous.
17:32:25 **Q.** Well if you look at page 2 of your report,
17:32:30 you see that there's diffusers there, and it looks
17:32:35 like it's to the right and above the pole?
17:32:40 **A.** Well yeah, but your question was is it
17:32:42 directly above the pole, and I can't tell from this
17:32:47 oblique view if it is directly above the pole. So I'm
17:32:50 just clarifying, the diffusers extend to the right,
17:32:55 but I don't know from this image or any image in the
17:32:57 report whether they are directly above the pole, and
17:32:59 that's the clarification I'm trying to make.
17:33:01 **Q.** Let's look it at it this way then. If you
17:33:03 look at figure number 4 you see air coming down from
17:33:10 the diffusers; correct?
17:33:12 **A.** That is correct.
17:33:12 **Q.** And it's coming to the left and right of the
17:33:14 pole and from the center of the pole, and -- like to

17:33:17 the left and right and within the pole area.
17:33:19 **A.** I think Figure 4 is a foot view. In fact
17:33:22 the caption says from the foot view of the surgical
17:33:24 table, so the pole is not visible in this image.
17:33:29 **Q.** You don't see the pole there to the right in
17:33:31 Figure 3?
17:33:34 **A.** Oh, I thought you were in Figure 4.
17:33:38 **Q.** Did I say Figure 4?
17:33:39 MR. GOSS: You said 4.
17:33:40 MR. ASSAAD: Okay. I'm sorry.
17:33:41 **Q.** Figure 3.
17:33:42 **A.** Okay.
17:33:42 MR. GOSS: Three.
17:33:45 **A.** Okay. In Figure 3 we see a pole, we see
17:33:50 downward air from the vent, but again this is a
17:33:54 two-dimensional image. So you asked is the vent
17:33:57 directly above the pole, and from this image I cannot
17:34:00 tell if the vent is directly above the pole.
17:34:02 **Q.** Let me --
17:34:03 Let's even make it simpler. You would agree
17:34:07 with me that there's a vent to the right of the pole
17:34:08 looking at Figure 7 in your report.
17:34:15 **A.** I believe that's the case, yes.
17:34:17 **Q.** Okay. And that's blowing down cold air at
17:34:19 15 degrees Celsius; correct?

17:34:21 **A.** Correct.
17:34:21 **Q.** Okay. And you agree with me that if you
17:34:25 look at Figure 3, that there is air being blown down
17:34:42 from -- Let me rephrase that.
17:34:49 You agree with me that there's air being
17:34:51 blown down from the diffusers that's going to be over
17:34:56 the region of where the air is exiting from the Bair
17:35:00 Hugger.
17:35:00 **A.** I believe that's the case, but I can't
17:35:03 confirm it from this image.
17:35:05 **Q.** Okay. But based on your work on this case
17:35:09 you have no reason to disagree with that; correct?
17:35:11 **A.** Well, I mean, I would want to look at the fi
17:35:14 -- the CAD files to verify. So I cannot say one way
17:35:17 or another where the vents are exactly with respect to
17:35:22 the operating table.
17:36:17 **Q.** Assume for my question that the ventilation
17:36:19 is over the Bair Hugger area where the Bair Hugger air
17:36:24 is exiting the Bair Hugger blanket, the inlet.
17:36:31 You understand my question? Assume that
17:36:33 fact.
17:36:33 **A.** Yes.
17:36:34 **Q.** You agree with me that there is cold air
17:36:37 from the diffuser going down onto -- over the area
17:36:42 where the air is exiting the Bair Hugger. Assuming

17:36:45 that fact to be true.
17:36:46 **A.** That may or may not be true.
17:36:49 **Q.** Okay. If that is true in this case, you
17:36:51 agree with me that the air is still rising, the hot --
17:36:56 the warm air is still rising even though there is a
17:37:00 downward flow from the diffuser.
17:37:04 **A.** No.
17:37:06 **Q.** You disagree with that.
17:37:07 **A.** Well, I mean, let's look at Figure 7. So
17:37:10 Figure 7 is shown on the camera.
17:37:13 So as I understand it what you're saying,
17:37:15 and I'm not going to write on this, but you're saying
17:37:18 that there is some diffuser that extends over the
17:37:22 anesthesia drape. I think that's true.
17:37:24 **Q.** Yes.
17:37:26 **A.** Okay. We -- You haven't said how far it
17:37:29 extends, but let's assume it extends some distance
17:37:31 over. What we see is the flow is going almost
17:37:34 perfectly horizontal, or the tem -- let's say this,
17:37:38 the temperatures are in a pattern that is almost
17:37:40 perfectly horizontal.
17:37:41 Now at some point the flow takes an upward
17:37:46 trajectory. I -- I don't know where the diffuser
17:37:51 ends. I can guess that the diffuser extends beyond
17:37:54 the surgical drape and that's what keeps the flow from

17:37:57 rising, and then when you get out of that safe area or
17:38:00 that -- that diffuser area then the air starts to
17:38:03 rise, and I think that's all we can tell from this
17:38:05 image.
17:38:06 **Q.** But your --
17:38:06 But there definitely has an upward slope;
17:38:09 correct?
17:38:09 **A.** Oh. It is a very small upward slope.
17:38:14 **Q.** But there is an upward slope; yes?
17:38:16 **A.** A very small upward slope.
17:38:18 **Q.** Whether it's small or large, you agree with
17:38:20 me that it's an -- there's an upward slope; correct?
17:38:22 **A.** I would agree that there is an upward slope.
17:38:52 **Q.** Okay. Now you --
17:38:54 I'm going to change directions a little bit
17:38:56 and I want to talk about the Gareis case and the
17:39:00 Gareis operating room; correct?
17:39:03 Now you put in your report that you're not
17:39:13 -- you basically state, I do not offer my calculations
17:39:15 as proof of what would have occurred in the Gareis
17:39:18 case, but rather as a demonstration of airflow
17:39:21 patterns in a typical OR during the use of the Model
17:39:24 505.
17:39:24 Did I read that correctly?
17:39:25 **A.** Yes.

17:39:27 **Q.** So is it -- are you going to offer any
17:39:28 opinions with respect to what is the airflow in the
17:39:32 Gareis case, in the Gareis -- in the Providence
17:39:35 operating room?
17:39:36 **A.** Well I'm --
17:39:37 My opinion is just what's written here, that
17:39:41 the flow patterns shown here are the typical flow
17:39:45 patter -- the flow patterns in a typical OR. The
17:39:48 Gareis case may have a different flow pattern, and I
17:39:52 didn't calculate that. So these are airflow patterns
17:39:56 in a typical OR, not necessarily the Gareis OR.
17:40:00 **Q.** Are you using your 505 model or CFD model to
17:40:11 support any of your opinions of the airflow that would
17:40:17 occur in the Gareis case?
17:40:24 **A.** Here's what I'll say. I did not model the
17:40:28 Gareis OR. I have modeled the typical -- And there
17:40:33 are differences between the Gareis OR and what I
17:40:35 modeled, and I'm acknowledging that.
17:40:39 My model is for a typical OR, the one that
17:40:42 we made the validating measurements in. I have seen
17:40:45 no evidence, despite trying, that Bair Hugger air can
17:40:50 influence the downward clean airflow in that OR, and I
17:40:55 have no reason to believe that it would influence the
17:40:59 airflow in the Gareis OR, but I did not model the
17:41:03 Gareis OR.

17:41:04 **Q.** And I understand that, sir. I'm just
17:41:06 wondering if you're using your -- Let me strike --
17:41:11 strike that.
17:41:12 Are you going to offer the opinion at trial
17:41:14 that the Bair Hugger 505 is not going to cause skin
17:41:23 squames to -- or particles to reach the operative
17:41:28 site?
17:41:30 MR. GOSS: In the Gareis OR?
17:41:32 MR. ASSAAD: Yes.
17:41:34 **A.** I'm going to answer that, and I'm actually
17:41:39 going to use my report. And I think I -- I'm taking a
17:42:13 little bit of time to look for it because I think that
17:42:15 I actually address this explicitly, so I apologize for
17:42:19 the time.
17:42:34 Okay. The calculation that I made differs
17:42:43 in some ways from the OR that was in the Gareis case.
17:42:47 I mention those in this report. For example, the dif
17:42:52 -- I'm reading from page 14 of Exhibit 1.
17:42:57 "In addition, the diffusers in Mr. Gareis's
17:43:01 OR create an 'air barrier' around the table,
17:43:04 potentially trapping contaminants shed by the surgical
17:43:07 staff within it."
17:43:09 Now what that means is I believe it is more
17:43:12 likely that skin squames, as you mentioned, from the
17:43:15 surgical staff would be carried to the site, but I

17:43:18 think it's less likely any potential Bair Hugger
17:43:22 airflow would interrupt that downward airflow.
17:43:25 **Q.** Is your basis with respect to the issue of
17:43:27 the Bair Hugger disrupting the Providence OR, is that
17:43:31 based on your CFD modeling of the 505 done in this
17:43:41 case?
17:43:43 **A.** The CFD modeling of the 505 shows that for
17:43:48 the OR that I modeled, not the Gareis OR, but the OR
17:43:53 that I modeled, the Bair Hugger air does not disrupt
17:43:56 the downward airflow.
17:43:58 **Q.** Does that he -- looking --
17:43:59 **A.** Here --
17:44:00 **Q.** Does that help you formulate your opinion
17:44:02 with respect to how the Bair Hugger is going to affect
17:44:04 the Gareis operating room?
17:44:06 **A.** It helps me formulate my opinion.
17:44:09 **Q.** Okay. So the basis of your opinion that the
17:44:11 Bair Hugger does not affect the operating -- operating
17:44:21 room used in the Gareis case is based on your
17:44:23 education, training and experience, and the results
17:44:26 that you obtained in your 505 modeling; correct?
17:44:30 **A.** And more than that.
17:44:32 **Q.** But is that correct so far?
17:44:33 If there's more, that's fine, but am I
17:44:35 correct?

17:44:36 **A.** Could you say it again?
17:44:37 **Q.** Okay. Your --
17:44:39 Your prediction or your opinion, within a
17:44:42 reasonable degree of engineering certainty, is that
17:44:44 the Bair Hugger is not going to have an effect on the
17:44:48 downward airflow in the Gareis operating room;
17:44:51 correct?
17:44:52 **A.** No. I wouldn't say that.
17:44:54 I would say this: I'm not making a
17:44:55 prediction about the Gareis OR. I'm not making a
17:44:59 prediction about the Gareis OR.
17:45:01 Here's what I am saying. I'm saying that I
17:45:04 simulated a different OR.
17:45:06 **Q.** I understand that, sir. I understand. My
17:45:08 question is simple.
17:45:10 Are you going to offer the opinion that the
17:45:12 Bair Hugger that was used in the Gareis case did not
17:45:16 affect the airflow in the Gareis OR?
17:45:23 **A.** The opinion I will offer is I have no
17:45:25 evidence, I've seen no evidence, and I have created no
17:45:29 evidence that the Bair Hugger would disrupt the
17:45:31 airflow in the Providence OR.
17:45:33 **Q.** But you have no evidence that it wouldn't,
17:45:35 either; correct?
17:45:36 **A.** Well that's not quite true, because you just

mentioned my simulation and my experience, evidence and training, and I'm --

Q. Okay. And --

A. -- I've given you two --

Q. And that's my question, sir. I'm not trying to interrupt you, I'm just running out of time.

You're going to rely on your education; correct?

A. Yes.

Q. Your training; correct?

A. Yes.

Q. Your experience; correct?

A. Yes.

Q. And the information you obtained from the 505 modeling of the CFD in a different operating room; correct?

A. Correct.

Q. To formulate your opinion that the Bair Hugger that was used in the Gareis case, in the Gareis OR is not going to result in increased number of squames or cause an increased number of squames over the surgical site; correct?

MR. GOSS: I object to form.

A. Here's what I'm going to --

Here's what I'm prepared to testify at

trial. The Bair Hugger does not disrupt clean airflow in a typical OR.

Q. Is the Gareis operating room a typical OR?

A. I do not believe it is a typical OR. I believe the Gareis operating room, based on my experience, education and training, would make it less likely that Bair Hugger air would influence the downward airflow, but I didn't simulate it so I can't say with absolute certainty.

Q. Okay. I'm asking for a reasonable degree of medical certainty, which is more than 50 percent. Do you understand that?

A. I don't -- I'm not familiar with a "reasonable degree of medical certainty."

Q. Or, I'm sorry, "engineering certainty."

Are you familiar with a reasonable degree of engineering certainty?

A. Yes.

Q. Okay. What I'm trying to figure out, and we've been going around in circles, is are you going to offer the opinion that the Bair Hugger would not cause squames to reach the operative site in the Gareis OR; "yes" or "no"?

A. I will offer this opinion. I have no evidence, I have seen no evidence that it could.

Q. Have you seen --

A. I did not simulate the Gareis OR.

Q. Have you seen any evidence to sup --

Well my question is: I understand you've seen no evidence, according to you, that it could, but are you going to offer the opinion that the Bair Hugger would have no effect on the airflow in the Gareis operating room and cause no squames to reach the surgical site?

MR. GOSS: I think that's compound. And I think he said what he's going to testify to.

MR. ASSAAD: He has not.

MR. GOSS: Well I think -- I think he said exactly what he's going to testify to, and you're trying to put a different opinion on him.

But if you have a different answer, you can offer it.

A. I don't have a different answer.

I believe the Bair Hugger will have some effect on any room. I have seen no evidence -- My simulation was on the Southdale OR only, and based on that simulation and my understanding that that's a typical OR, I offer the opinion that I don't believe the Bair Hugger could bring any unclean air into the surgical site in that type of OR.

Q. What about in the Gareis OR?

A. I have not simulated the Gareis OR.

Q. So you're going to offer no opinion with respect to whether or not the Bair Hugger could cause increased squames to reach the surgical site in the Gareis OR because you have not simulated it; correct?

MR. GOSS: Object to form.

A. I would say that this -- my calculations are not predictions of what would happen in the Gareis OR, they are demonstratives of what happens in a typical OR.

Q. Are you going to use that demonstrative and your calculations to offer opinions at trial with respect to whether or not the Bair Hugger increases particles over the sterile field in the Gareis case?

A. I did not simulate any increase of particles. I didn't model particles.

Q. Let me ask it this way: And I'm just trying to understand what you're going to testify at trial, and that's why I'm here today.

Are you going to offer any opinions at trial in the Gareis case of whether or not the Bair Hugger 505 device affects or impacts the OR airflow to an extent in which particles may be in contact with the sterile field?

17:50:57 **A.** That was long. Let me read it. (Witness
17:51:06 reviewing realtime screen.)
17:51:16 Well I'll just say this. My -- I'm going to
17:51:19 give my answer. These results are not predictive of
17:51:23 what would actually happen in the Gareis OR. They are
17:51:27 predictions in a typical OR like the one that was
17:51:31 modeled.
17:51:32 **Q.** I understand.
17:51:34 But based on your education, training, and
17:51:37 experience and the CFD modeling, do you have an
17:51:40 opinion, within a reasonable degree of engineering
17:51:43 probability, of whether or not the Bair Hugger will
17:51:47 have a impact on the airflow over the surgical site in
17:51:53 the Gareis case?
17:51:55 MR. GOSS: So now we've gone from is he
17:51:57 going to offer an opinion at trial to, do you have an
17:51:59 opinion.
17:51:59 MR. ASSAAD: Yes.
17:52:01 **A.** I do have an opinion.
17:52:03 **Q.** And what's your opinion?
17:52:04 **A.** My opinion is that the Bair Hugger would
17:52:09 not.
17:52:09 **Q.** And what's the basis of your opinion?
17:52:16 **A.** My experience, my training, my understanding
17:52:21 of how these blankets work, my review of the

17:52:25 literature and other people's studies, my own review,
17:52:30 I have seen no evidence in any OR that the Bair Hugger
17:52:36 will bring particles to the sterile site.
17:52:39 **Q.** And that's based also on your CFD analysis
17:52:42 and the OR models in your 505.
17:52:45 **A.** Boy, I don't know if I would go that far,
17:52:47 though, because this is a different room, so I don't
17:52:52 -- I don't know if I would go that far. I don't think
17:52:54 I need to go that far, and I don't know, sitting here,
17:52:56 if I would go that far.
17:52:57 **Q.** So basically what you're telling me is at
17:53:00 trial your 505 CFD modeling in the Gareis case is
17:53:06 irrelevant with respect to your opinions.
17:53:08 MR. GOSS: I'm going to object to form. He
17:53:09 has general cause opinions.
17:53:12 **A.** I disagree. It is not irrelevant.
17:53:14 **Q.** So it is relevant and it formulates your
17:53:17 education, training and experience with respect to how
17:53:19 the Bair Hugger acts in an operating room.
17:53:21 **A.** This 505 report is related to how a Bair
17:53:26 Hugger 505 would affect the airflow in a typical OR,
17:53:31 period. This report does not make any claims or
17:53:36 predictions about how the 505 would impact the airflow
17:53:39 in the Gareis OR, period.
17:54:03 THE VIDEOGRAPHER: We have 15 minutes

17:54:05 remaining.
17:54:11 BY MR. ASSAAD:
17:54:11 **Q.** So would it be accurate that with respect to
17:54:17 the effect of the Bair Hugger in the Gareis operating
17:54:20 room, you're not going to rely on the information you
17:54:23 obtained from your 505 CFD analysis?
17:54:35 **A.** (Witness reviewing realtime screen.) I am
17:54:40 not making any claim about the Bair Hugger effect in
17:54:45 the Gareis operating room, so I wouldn't rely on
17:54:50 information to make something I'm not going to claim.
17:54:59 MR. ASSAAD: Let's take a break.
17:55:01 THE REPORTER: Off the record, please.
17:55:03 (Recess taken from 5:55 to 6:02 p.m.)
18:02:07 BY MR. ASSAAD:
18:02:19 **Q.** Dr. Abraham, my questions now are going to
18:02:22 be dealing with specifically the Gareis case. You
18:02:24 understand that.
18:02:25 **A.** Yes.
18:02:26 **Q.** Okay. In short, you're offering the opinion
18:02:33 that the Bair Hugger cannot deposit squames containing
18:02:37 bacteria to the surgical site; correct?
18:02:39 MR. GOSS: Object to form.
18:02:41 **A.** My opinion is the Bair Hugger models that I
18:02:46 have modeled in the OR that I have modeled, there is
18:02:51 no evidence that the Bair Hugger would deposit squames

18:02:53 to the surgical site.
18:02:54 **Q.** I'm asking about the Gareis case.
18:02:56 **A.** My model is not the Gareis case, so I'm not
18:03:00 making predictions of what happened in the Gareis
18:03:03 case.
18:03:32 **Q.** So are you withdrawing your 505 model with
18:03:36 respect to what would occur in the Gareis case?
18:03:43 MR. GOSS: Object to form. I think that
18:03:45 goes to legal strategy, but I'll ask --
18:03:51 MR. ASSAAD: I understand that, Mr. Goss,
18:03:52 but I'm trying to figure out if he's going to offer
18:03:55 opinions with respect to what's going to happen in
18:04:01 the Gareis case because he -- his case-specific
18:04:05 report contains a 505 CFD model.
18:04:08 MR. GOSS: True.
18:04:09 MR. ASSAAD: Well let me ask you this: Is
18:04:11 he going to offer any opinions in the Gareis case
18:04:13 with respect to whether or not the Bair Hugger could
18:04:16 cause squames to -- containing bacteria to reach the
18:04:20 surgical site?
18:04:21 MR. GOSS: Well I'm not going to testify
18:04:24 about what the direct is going to be, but I think
18:04:28 he's already indicated what his opinions are and what
18:04:33 his -- what his views are on the extent to which you
18:04:38 can extend the 505 model to the specifics of the

Gareis case.
MR. ASSAAD: Okay.
BY MR. ASSAAD:
Q. Now with respect to --
This goes to your 505 model. You agree that the 505 model, CFD model that you did only lasted 5.07 seconds; correct?
A. The results that are presented here were extracted from the TRN file that corresponds to 5.07 seconds.
Q. And when you talk about the results you're talking about the 60-second path -- streamlines; correct?
A. That is correct.
Q. You do understand that Mr. Gareis' surgery lasted longer than a minute.
A. I understand that.
Q. Okay. Much longer than a minute. Do you understand that?
A. Yes.
Q. Do you even know how long it takes to do the first incision on a hip arthroplasty?
A. I don't know that.
Q. With respect to your general cause report regarding the 750, what specifically in that report

applies to the Gareis case?
A. Well, I mean, it's a different blower and it's a different OR. What the general causation report shows is what airflow would occur in an O -- in that OR with that blower, and that in that OR with that blower the Bair Hugger does not bring unclean air to the surgical site.
It doesn't -- That general causation report had nothing to do with the Gareis case.
Q. And my question is since it applies to that operating room, according to you, and those scenarios, your general causation report would not apply to what occurs in the Gareis case; correct?
A. My general causation report would not be predictive of what would happen in a Gareis OR, as I've stated here with the 505.
Q. And you're not using your 750 CFD or -- IN general causation, or your 505 CFD done in your case-specific report to predict how the Bair Hugger is going to affect airflow in the Gareis operating room; correct?
A. I am not making any predictions about the Bair Hugger and its effect of airflow in that OR. That was not modeled.
MR. ASSAAD: Mr. Goss, are you going to

withdraw your case-specific opinions with respect to the 505 CFD analysis since your expert just testified that it's basically not relevant to the Gareis case?
MR. GOSS: No, of course not.
MR. ASSAAD: Okay.
MR. GOSS: No more than any of your experts are not going to offer any general causation testimony in the Gareis case. He -- It's a rebuttal model.
Q. With respect to page 14 where you indicate "...the diffusers in Mr. Gareis's OR create an 'air barrier' around the table, potentially trapping contaminants shed by the surgical staff within it."
Do you see that?
A. Yes.
Q. What's your basis for that opinion?
A. If you go to the next page and look at Figure 18, I have highlighted where the diffusers are in the ceiling, and you can see that the diffusers create an air barrier, they're like a wall around the surgical site -- around the operating room table.
Q. I'm running out of time, so keep it short. You're basing it on Figure 18?
A. Well I need to explain it.
Q. I understand where you're going with it, but

you're basing it on Figure 18?
A. You may understand where I'm going with it.
Are you asking me not to explain it, or --
Q. Well I'll ask you to explain it if your counsel will give me an extra ten more minutes, but if not, I don't want to --
MR. GOSS: No. There's no more time. It's disclosed in his report.
MR. ASSAAD: Okay.
Q. And you're making that opinion based on your education, training and experience and your knowledge of airflow; correct?
A. Yes.
Q. Okay. And you could look at Figure 18 and as an engineer you can make predictions on an airflow in an operating room based on your education, training and experience.
A. You could make some predictions.
Q. But your basis with respect to the OR in the Gareis room creating an air barrier is based on your education, training and experience, and no calcula -- CFD calculations; correct?
A. And the layout of the diffusers in the ceiling, which create a barrier around the table, which is displayed in Figure 18.

18:10:57 **Q.** But it's not based on any CFD calculations;
18:11:00 correct?
18:11:00 **A.** That is correct.
18:11:07 **Q.** With respect to page 16, there's a picture
18:11:11 of the outlet vent in the Gareis operating room;
18:11:15 correct?
18:11:16 **A.** Yes.
18:11:16 **Q.** And you write, this vent draws air upwards
18:11:19 above the operating room table; correct?
18:11:20 **A.** That is correct.
18:11:21 **Q.** You did not provide any calculations or
18:11:23 conduct any calculations to -- to show that
18:11:27 conclusion; correct?
18:11:29 **A.** No. That conclusion is based on my
18:11:31 experience, education and training.
18:12:34 **Q.** Furthermore, with respect to the medical
18:12:37 equipment in the operating room, such as the
18:12:39 anesthesia machine, the electrocautery device, you did
18:12:45 not perform any calculations to determine the effect,
18:12:48 if any, those devices might have on the airflow in the
18:12:51 Gareis operating room; correct?
18:12:53 **A.** That is correct.
18:12:53 **Q.** And you're not going to offer any opinions
18:12:55 with respect to the effect of those devices on the
18:12:58 airflow in the operating room; correct?

18:13:00 MR. GOSS: Object to form.
18:13:01 **A.** I think what I can say categorically is that
18:13:09 anything that generates heat may cause an upward air
18:13:12 motion, buoyancy, but I would not make a prediction
18:13:14 about how that would affect the airflow in the Gareis
18:13:17 OR.
18:13:18 **Q.** So you're not going to offer any opinions
18:13:20 within a reasonable degree of medical -- engineering
18:13:22 probability, that the anesthesia machine, or the Bovie
18:13:27 machine, or any other equipment in the Gareis
18:13:29 operating room had a significant effect on the airflow
18:13:37 in the operating room.
18:13:39 MR. GOSS: Object to form.
18:13:40 **A.** Correct.
18:14:21 **Q.** With respect to your published article, have
18:14:24 you received any questions or emails from other people
18:14:34 -- other people in your field regarding what was
18:14:35 published in*Numerical Heat Transfer*?
18:14:38 **A.** I don't recall receiving any questions or
18:14:40 emails on it. It's possible I've got an email, but I
18:14:43 don't recall any emails or questions.
18:14:45 **Q.** And have you provided -- before you
18:14:48 submitted the transcript did you give any copies -- or
18:14:51 the manuscript, I'm sorry, manuscript, to any of your
18:14:55 colleagues at St. Thomas --

18:14:57 **A.** No.
18:14:57 **Q.** -- to review?
18:14:58 **A.** No.
18:14:58 **Q.** Did you give it to any colleagues at the
18:15:01 University of Minnesota to review?
18:15:02 **A.** No.
18:15:04 **Q.** So sitting here today, with respect to your
18:15:07 published transcript, you received no comments or
18:15:11 reviews from anyone in -- any of your colleagues or --
18:15:20 in your field of mechanical engineering; is that
18:15:23 correct?
18:15:23 **A.** I received no comments on this paper from
18:15:26 any of my colleagues.
18:15:28 **Q.** Pre and post publication.
18:15:30 **A.** Correct.
18:15:32 MR. GOSS: Except for Dr. Minkowycz.
18:15:34 THE WITNESS: Right.
18:15:34 **A.** But I think you were talking about at my
18:15:36 university.
18:15:37 **Q.** Anywhere.
18:15:38 **A.** The only comments I've gotten was the letter
18:15:40 from the editor-in-chief.
18:15:43 **Q.** Okay.
18:15:44 MR. ASSAAD: That's all I have.
18:15:46 THE WITNESS: Okay.

18:15:46 MR. GOSS: Nothing.
18:15:48 MR. ASSAAD: I ask him to read and sign,
18:15:50 please.
18:15:51 MR. GOSS: Okay.
18:15:51 THE REPORTER: Off the record, please.
18:15:53 (Deposition concluded at 6:15 p.m.)

C E R T I F I C A T E

I, Debby J. Campeau, hereby certify that I am qualified as a verbatim shorthand reporter; that I took in stenographic shorthand the testimony of JOHN P. ABRAHAM, Ph.D., at the time and place aforesaid; and that the foregoing transcript consisting of 288 pages is a true and correct, full and complete transcription of said shorthand notes, to the best of my ability; that the noticing party has been charged for the original transcript, and that each party has been charged the same amount for a copy of the transcript.

Dated at Lino Lakes, Minnesota, this 20th day of February, 2018.

DEBBY J. CAMPEAU
Notary Public

S I G N A T U R E P A G E

I, JOHN P. ABRAHAM, Ph.D., the deponent, hereby certify that I have read the foregoing transcript, consisting of 288 pages, and that said transcript is a true and correct, full and complete transcription of my deposition, except per the attached corrections, if any.

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Date Signature of Witness

WITNESS MY HAND AND SEAL this _____ day of _____, 2018.

(DJC) _____